

1892.

NEW SOUTH WALES.

REPORT

OF THE

ROYAL COMMISSION

OF

INQUIRY INTO THE ALLEGED DEFECTIVENESS
AND UNSUITABILITY

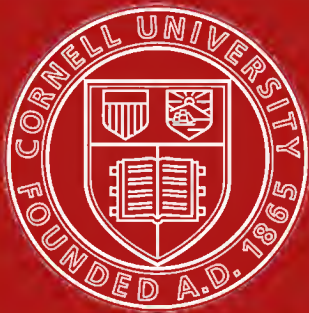
OF THE

BALDWIN LOCOMOTIVES.

APPOINTED MARCH 15, 1892.



Presented to Parliament by Command.



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SYDNEY : CHARLES POTTER, GOVERNMENT PRINTER.

1892.

[10s.]

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Commission.

VICTORIA, by the Grace of God, of the United Kingdom of Great Britain and Ireland, Queen,
Defender of the Faith, and so forth,—

To our trusty and well-beloved—

FRANCIS EDWARD ROGERS, Esquire, One of Our Counsél learned in the Law, President.

WILLIAM HENRY WARREN, Esquire, Member of the Institute of Civil Engineers, Professor of
Engineering of the University of Sydney.

ALEXANDER BROWN, Esquire, a Justice of the Peace of Our Colony of New South Wales.

Greeting:—

KNOW ye, that We, reposing great trust and confidence in your ability, zeal, industry, discretion, and integrity, do by these presents authorise and appoint you, or any two of you, as hereinafter mentioned, to make a diligent and full inquiry into the allegations made, that the recently imported Baldwin Locomotives are defective and unsuitable to the Permanent Way of the Railways of Our said Colony of New South Wales, and are not rendering that service which was expected of them: And We do, by these presents, grant to you, or any two of you, at any meeting or meetings to which all of you shall have been duly summoned, full power and authority to call before you all such persons as you may judge necessary, by whom you may be better informed of the truth in the premises, and to require the production of all such books, papers, writings, and all other documents as you may deem expedient, and to visit and inspect the same at the offices or places where the same or any of them may be deposited, and to inquire of the premises by all lawful ways and means: And We do give you power, at your discretion, to procure such clerical and other assistance as you may deem necessary for enabling you duly to execute this Our Commission: And Our further will and pleasure is, that you do within two months after the date of this Our Commission, certify to Us, in the office of Our Colonial Treasurer, under your or any two of your hands and seals, what you shall find touching the premises: And We hereby command all Government officers and other persons whomsoever within Our said Colony that they be assistant to you and each of you in the execution of these presents: And We appoint you the said FRANCIS EDWARD ROGERS, Esq., to be President of this Our Commission, which said Commission We declare to be a Commission for all purposes of the Act 44 Victoriæ No. 1, intituled, "*An Act to regulate the taking of evidence by Commissioners under the Great Seal.*"

In testimony whereof, We have caused these Our Letters to be made Patent, and the Great Seal of Our said Colony of New South Wales to be hereunto affixed.

Witness, Our Right Trusty and Right Well-beloved Cousin and Councillor, VICTOR ALBERT GEORGE, EARL OF JERSEY, Knight Grand Cross of Our Most Distinguished Order of Saint Michael and Saint George, Our Governor and Commander-in-Chief of Our Colony of New South Wales and its Dependencies, at Government House, Sydney, in New South Wales aforesaid, this fifteenth day of March, in the fifty-fifth year of Our Reign, and in the year of Our Lord one thousand eight hundred and ninety-two.

(L.S.)

JERSEY.

EXTENSION OF COMMISSION.

WHEREAS it is necessary to extend the time by which the Commissioners are to make their report in the above matter: Now, therefore, I do hereby, with the advice of the Executive Council, extend the time within which the said Commissioners are to make such report until the fifteenth July next.

Given under my hand at Government House, Sydney, this twelfth day of May, one thousand eight hundred and ninety-two.

JERSEY.

By His Excellency's Command,
F. B. SUTTOR.

BALDWIN LOCOMOTIVES INQUIRY COMMISSION.

MINUTES OF MEETINGS.

TUESDAY, 5 APRIL, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The Commission was read.

Edward George Jerrom was appointed messenger to the Commission at a weekly salary of £2 2s.

Resolved,—That the times of meeting be from 2 to 5 o'clock on Tuesday and Wednesday afternoons, and from 2 to 4.30 o'clock on Thursday afternoon.

The Chief Commissioner of Railways was called in and questioned briefly with regard to the general nature of the allegations made in Parliament and elsewhere in respect of the Baldwin Engines.

The Secretary was instructed to summon Mr. Henry Hoyle, M.P., as the witness for the following Tuesday.

TUESDAY, 12 APRIL, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

A letter was read from Messrs. R. Towns & Co., agents for New South Wales for the Baldwin Locomotive Co., requesting that the Company might be allowed to have a representative at the inquiry.

The Chief Commissioner of Railways asked, on behalf of himself and colleagues, permission to employ legal assistance at the inquiry.

The President stated that the inquiry would be conducted in public, and that, therefore, there would be no objection to the presence of any person. Those interested in the inquiry might, during the proceedings, take counsel with legal friends. It was not, however, thought desirable that witnesses should be examined except by the gentlemen composing the Commission, who would, at suitable times, ask any pertinent questions that might be suggested to them.

Mr. Henry Hoyle, M.P., was sworn and examined.

WEDNESDAY, 13 APRIL, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were examined :—Mr. David Carnegie Simpson, Divisional Engineer in the Metropolitan District; Mr. Edward Millar Gard Eddy, Chief Commissioner of Railways; Mr. Deodatus Hilin Neale, A.M.I.C.E., Mechanical Engineer on the staff of the Railway Commissioners.

THURSDAY, 14 APRIL, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were examined :—Mr. Deodatus Hilin Neale, A.M.I.C.E., Mechanical Engineer on the staff of the Railway Commissioners; Mr. William T. Foxlee, M.I.C.E., Engineer-in-Chief for Existing Lines; Mr. William Thow, M.I.C.E., Chief Mechanical Engineer.

WEDNESDAY, 20 APRIL, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were examined :—Mr. Henry B. Howe, Workshop Manager; Mr. Henry H. Park, Shed Foreman, Penrith; Mr. William Wilson, Locomotive Inspector, Bathurst.

THURSDAY,

THURSDAY, 21. APRIL, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

Mr. William Wilson amended the evidence given by him on the previous day.

The following witnesses were examined :—Mr. William Pilford, Shed Inspector, Newcastle District ; Mr. Isaac Gregory, Shed Foreman, Penrith ; Mr. Henry Robinson, on the staff of the Locomotive Superintendent ; Mr. Charles Baggs, Sub-inspector Locomotive Department, Esk Bank ; Mr. Henry Deane, Engineer-in-Chief to the railways of New South Wales.

TUESDAY, 26 APRIL, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were examined :—Mr. Edward Molloy Halligan, Divisional Engineer in the Northern Division ; Mr. John Love, Steam-shed Inspector, Junee ; Mr. John Fullerton, Engine-driver ; Mr. Charles Hursthouse Stanger, Outdoor Locomotive Superintendent, in charge of the Northern and Western Divisions ; Mr. Thos. Rhodes Firth, Chief Assistant Engineer in the Construction Branch ; Mr. Stanley Alexander.

WEDNESDAY, 27 APRIL, 1892.

PRESENT :—

Francis Edward Rogers Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J. P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were examined :—Mr. G. Cowdery, Civil Engineer, and Mr. J. Hordern, Engine-driver.

The Commission proceeded on a visit of inspection to the Locomotive sheds at Eveleigh returning to the Colonial Secretary's Office too late in the afternoon to hear further evidence.

At its rising the Commission adjourned to Tuesday the 3rd May to enable Mr. Hoyle to visit the scene of the disastrous railway accident that had occurred that morning near Tarana.

TUESDAY, 3 MAY, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq. J. P.

The minutes of the previous meeting were read and confirmed.

Mr. Thomas Midelton, Mechanical Engineer, was examined.

WEDNESDAY, 4 MAY, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J. P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were examined :—Mr. Thomas Midelton, Mr. Joshua Rushworth.

THURSDAY, 5 MAY, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were examined :—Henry Joseph Moses, Engine-driver ; William Wilson, Ganger ; Walter Marshall Foote, Steel-worker.

TUESDAY, 10 MAY, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were examined :—Charles Augustus Goodchap, late Commissioner for Railways ; George Cowdery, late Engineer for Existing Lines ; James Isaac Haycroft, Engineer for the Borough of Woollahra ; Alexander Duff.

WEDNESDAY.

WEDNESDAY, 11 MAY, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
 Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were examined :—Jeremiah Tuites, Manager for Messrs. Proudfoot and Co., Tarana; Alexander Ferrier Watson, Divisional Engineer; Henry H. Park, Shed Inspector; William Nield, Driver; Alexander Page, Driver; William Young, Driver; Patrick Hayes, Ganger; John Sloane, Ganger; James Walsh, Ganger.

THURSDAY, 12 MAY, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
 Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were examined :—Samuel Joseph Pollitzer, Consulting Engineer; James Dunbar, Manager for Messrs. Proudfoot & Co., Bathurst; Frederick Elliott, engine driver; Patrick Dwyer, ganger; George Frederick Evans, locomotive fireman; George Yates, shed foreman, Dubbo; William Rhodes, mechanical engineer for the Baldwin Locomotive Company.

FRIDAY, 13 MAY, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
 Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

William Rhodes, mechanical engineer for the Baldwin Locomotive Company, was further examined.

SUNDAY, 15 MAY, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
 Professor Warren, M.I.C.E.

The minutes of the previous meeting were postponed.

The Commission proceeded with a trial train to Picton, and during the day various tests were made with Baldwin passenger engine No. 447.

The first trial was from Picton to Picton Lakes, up a gradient of 1 in 40, and the load hauled was 179 tons. The engine returned tender first to Picton, and again traversed the 1 in 40 gradient between there and Picton Lakes, this time with a load of 157 tons 12 cwt.

From Picton Lakes the engine proceeded to Hill Top, the load being 121 tons 14 cwt., and the gradient 1 in 30; and after returning tender first to Picton Lakes, again took the incline of 1 in 30, the load on this occasion being 144 tons 2 cwt.

Subsequently, as a test of speed, the engine travelled with a load of 157 tons 12 cwt. from Picton to Thirlmere.

TUESDAY, 17 MAY, 1892.

PRESENT :—

Alexander Brown, Esq., J.P., Acting President.
 Professor Warren, M.I.C.E.

The minutes of the previous meeting were read and confirmed.

Samuel Joseph Pollitzer, C.E., made a voluntary statement in regard to the evidence given by him on Thursday the 12th instant.

Albert Leahy, C.E., was examined.

Mr. Hoyle intimated that he had no further evidence to call, and at the request of Mr. Fehon the proceedings were then adjourned to the following day.

WEDNESDAY, 18 MAY, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
 Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

Edward Millar Gard Eddy, A.I.C.E., Chief Railway Commissioner of New South Wales, made a statement preparatory to the calling of witnesses by the Railway Commissioners.

THURSDAY, 19 MAY, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
 Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were examined :—Hugh M'Lachlan, Secretary to the Railway Commissioners; John Grady, ganger on the New South Wales Railways; John Berghoffer, ganger on the New South Wales Railways; Charles Lowe, ganger on the New South Wales Railways; John M'Peak, ganger on the New South Wales Railways; William King, Sub-Inspector of Permanent way on the New South Wales Railways; Edward Robins, Inspector of Permanent way on the New South Wales Railways.

WEDNESDAY,

WEDNESDAY, 25 MAY, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were examined :—Richard Waring, Chief Inspector on the New South Wales Railways ; James Fraser, assistant to the Engineer-in-Chief for Existing Lines ; William T. Foxlee, M.I.C.E., Engineer-in-Chief for Existing Lines.

THURSDAY, 26 MAY, 1892.

PRESENT ;—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were called and examined :—Mr. William Thow, M.I.C.E., Chief Mechanical Engineer in the service of the New South Wales Railways ; Mr. Charles Hursthouse Stanger, Out-door Locomotive Superintendent in the service of the New South Wales Railways.

FRIDAY, 27 MAY, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were examined :—William Thow, M.I.C.E., Chief Mechanical Engineer in the service of the New South Wales Railways ; Edwin Molloy Halligan, Shed Foreman, Newcastle ; Robert Pollock, Consulting Engineer ; Howell Bland, Assistant Receiving Foreman at Eveleigh ; John Chudleigh, Engine-driver on the New South Wales Railways ; W. W. Young, Engine-driver on the New South Wales Railways ; Henry Robinson, Civil Engineer in the service of the New South Wales Railways ; Deodatus Hilin Neale, Assoc. M.I.C.E., Mechanical Engineer in the service of the New South Wales Railways.

TUESDAY, 31 MAY, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The following witnesses were further examined :—Henry Deane, Chief Engineer in the Railway Construction Branch ; Deodatus Hilin Neale, Assoc. M.I.C.E., Mechanical Engineer in the service of the New South Wales Railways.

WEDNESDAY, 1 JUNE, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

George Cowdery, C.E., made a voluntary statement in regard to the evidence given by him when previously before the Commission.

Edward Millar Gard Eddy, Chief Railway Commissioner, was examined by Mr. Brown Mr. Hoyle, in consequence of statements made by Mr. Eddy, refusing to cross-examine him.

THURSDAY, 2 JUNE, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The Commission proceeded to the consideration of the Report.

THURSDAY, 9 JUNE, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.
Professor Warren, M.I.C.E., | Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The Commission further considered the Report.

THURSDAY.

THURSDAY, 16 JUNE, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.

Professor Warren, M.I.C.E.,

Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The Report was further considered.

FRIDAY, 17 JUNE, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C. President.

Professor Warren, M.I.C.E.,

Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The following witness was examined:—Mr. William Thow, M.I.C.E., and M.I.M.E., Chief Mechanical Engineer in the service of the New South Wales Railways.

WEDNESDAY, 22 JUNE, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.

Professor Warren, M.I.C.E.

Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The Report was further considered.

TUESDAY, 28 JUNE, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.

Professor Warren, M.I.C.E.

The minutes of the previous meeting were postponed.

The Report was further considered.

WEDNESDAY, 29 JUNE, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.

Professor Warren, M.I.C.E.

Alexander Brown, Esq., J.P.

The minutes of the two previous meetings were read and confirmed.

The Report was further considered.

THURSDAY, 30 JUNE, 1892.

PRESENT :—

Francis Edward Rogers, Esq., Q.C., President.

Professor Warren, M.I.C.E.

Alexander Brown, Esq., J.P.

The minutes of the previous meeting were read and confirmed.

The Report was adopted.

THURSDAY, 14 JULY, 1892.

PRESENT :—

F. E. Rogers, Esq., Q.C., President.

Professor Warren, M.I.C.E.,

The Hon. Alex. Brown, M.L.C.

The minutes of the previous meeting were read and confirmed.

The balance sheet was produced and read.

The accounts were passed.

14 July, 1892.

F. E. ROGERS,
President.

BALDWIN ENGINES COMMISSION.

REPORT.

To His Excellency The Right Honorable VICTOR ALBERT GEORGE,
EARL OF JERSEY, a Member of Her Majesty's Most Honorable Privy
Council, Knight Grand Cross of the Most Distinguished Order of Saint
Michael and Saint George, Governor and Commander-in-Chief of the
Colony of New South Wales and its Dependencies.

MAY IT PLEASE YOUR EXCELLENCY,—

We, the Commissioners appointed by Your Excellency on the 15th day of March, 1892, "to make a diligent and full inquiry into the allegations made, that the recently imported Baldwin Locomotives are defective and unsuitable to the Permanent-way of the Railways of your said Colony of New South Wales, and are not rendering that service which was expected of them," have the honor to submit the following Report :—

It appears that about the month of August, 1890, and prior to the ordering of the Baldwin locomotives, various negotiations for the supply of engines to be built in the Colony had failed, and English locomotive builders were unable to promptly supply engines sufficient for the then requirements of the Railway Service of the Colony. Under these circumstances, the Railway Commissioners, finding that the exigencies of traffic (especially that anticipated in wool during the then approaching wool season) demanded the immediate supply of further engine power, appointed a committee of responsible officers in the New South Wales Railway Service, consisting of Mr. D. H. Neale (Mechanical Engineer), Messrs. Loughry and Stanger (Outdoor Locomotive Superintendents), and Mr. Howe (Workshop Manager), to report upon the merits of the 10-wheel American express passenger and the consolidation goods engines, the information to hand regarding which was that such engines had been tried with most satisfactory results in the United States on railway lines resembling in many respects those of New South Wales. This Committee had before them the specification of an engine which had been supplied by the Baldwin Co. to the Baltimore and Ohio Railroad Co., and which appeared to the Committee to be suitable in every respect for the railways of New South Wales. After careful consideration, the Committee advised the Railway Commissioners to order from the Baldwin Co. engines of a similar character to that described in the specification, subject to certain modifications in construction, which they considered would render the engines more suitable to the conditions existing in the Colony, and these modifications appear to your Commissioners, as far as the evidence enables them to judge, to have been judicious. In consequence of the Report twelve passenger engines were ordered and obtained from the Baldwin Co., and subsequently twenty engines for goods traffic were ordered and obtained from the same company (including two engines on the compound system, which were ordered by way of experiment, and which need not be considered in this Report).

Report,
1 September,
1890
(page 302).

The sufficiency and merits of the passenger and goods engines so obtained are the matters respecting which your Commissioners are directed to inquire.

AS

AS TO THE ALLEGED DEFECTIVENESS OF THE BALDWIN LOCOMOTIVES.

Soon after the locomotives were imported and allowed to run, various defects developed themselves, all of which, it is stated, have been remedied at the expense of the Baldwin Co. Of the defects which manifested themselves it now seems only important to draw attention to the very grave one shown by the undue heating and eventual breaking of certain bogie and tender axles, which, on being tested, proved to have been made of very inferior iron. On their being informed of the breakages, the explanation of the Baldwin Co. was that the axles had been obtained by them from a manufacturer whose product had been hitherto largely used with good results, and that as the axles were supposed to be made of selected scrap-iron, no test had been prescribed, as no test of scrap-iron axles is conclusive. Subsequent events showed that it was most unfortunate that no test was made by the Baldwin Co., as most probably it would not then have been left for the above mentioned breakages to lead to the discovery that the material used in these axles was most unsuitable for its purpose. Unquestionably the Railway Commissioners would, if possible, have had an inspection of these engines during their construction similar to the practice in that respect which is observed in England when engines are there manufactured for the Railway Service of this Colony, and, as a matter of fact, they authorised Mr. Thow, the Chief Mechanical Engineer in the New South Wales Railway Service, who was about to visit America on his way from England to this Colony, to have an inspector appointed if he deemed it desirable; but, on reaching America, Mr. Thow appears to have consulted with the most reliable authorities in that country, from whom he ascertained that it was very unusual to appoint an inspector over engines built by such a firm as the Baldwin Co.; and as it had been left to the Baldwin Co. to do their best to supply thoroughly efficient and serviceable engines which would do credit to their builders, and as Mr. Thow was not in a position to give a specification or set of drawings to an inspector, such an officer could not have been of any practical use, especially under a contract which did not provide for the supervision, or in any way recognise the authority of an inspector. And it seems that Mr. Thow very properly concluded that the appointment of an inspector would be more likely to relieve the Baldwin Co. of the responsibility which rested upon them than be of any practical service. The construction of the locomotives was, therefore, carried through without the employment of an inspector, and after their completion and arrival in this Colony they were erected and put into steam under the supervision of an engineer sent for that purpose by the Baldwin Co. No test of the material in the engines was at that time applied in this Colony. Any test that could have been applied would have involved the destruction of the parts tested, and the Railway Commissioners had not then any reason to doubt the sufficiency of the material in all parts of locomotives supplied by a firm of the standing and reputation of the Baldwin Co. It is to be borne in mind that it was only after the Baldwin Co. had been told of the breakages that the Railway Commissioners were informed by them of the facts relating to the supply of the axles, and that no test of them had been prescribed. As soon as the defectiveness of the axles was established all the bogie and tender axles were removed, steel ones were substituted at the expense of the Baldwin Co., and the locomotives were again put into service. Since then three tires of tender wheels have broken, and in some twelve or fifteen cases engine wheels have worked loose on their axles. As such occurrences are unusual on engines which have only given the service which has been obtained from these locomotives, your Commissioners cannot too strongly approve of the recent determination of the Railway Commissioners to forthwith remove the wheels and axles of all the passenger locomotives, with a view of having them properly tested, which has rendered unnecessary a recommendation to that effect which your Commissioners would otherwise have felt it their duty to make. Since that decision was arrived at, the tires and axles have been tested under the supervision of Professor Warren, whose report (appended hereto) shows that the steel of which the tires are made is not sufficiently uniform in quality, and is too hard and brittle, and thus renders them very liable to fracture. The testing of one of the driving-axles under the falling weight showed that its material is defective and unsafe for passenger traffic, but whether the remaining axles may suffice for use in goods traffic, where the slower rate

Letter, 15th
February,
1892
(page 314).

See Mr.
McLachlan's
letter of 22nd
Sept., 1890
(page 304),
and Mr.
Thow's reply
thereto, dated
8th Dec., 1891
(page 317).

rate of speed observed renders them less liable to fracture, can only be decided when further tests shall have been made—such as tensile and bending tests on specimens cut from the axle fractured by the process above mentioned.

AS TO THE ALLEGED UNSUITABILITY OF THE BALDWIN LOCOMOTIVES TO THE PERMANENT-WAY OF THE NEW SOUTH WALES RAILWAYS.

The permanent-way consists at present of six kinds of rails: Iron rails, double-headed, originally weighing 75 lb. to the yard; flat-based Vignole or T rails, weighing $71\frac{1}{2}$ lb. per yard; steel rails, bull-headed and flat-based, weighing 80 lb. per yard; double-headed steel rails, weighing 75 lb. per yard; flat-based steel rails, weighing $71\frac{1}{2}$ lb. per yard. Since the Railway Commissioners came into office over 200 miles of the lines have been laid with 80-lb. steel rails on ironbark sleepers, which average in weight 2 cwt. 1 qr., placed 2 ft. 7 in. from centre to centre. It is proposed by them that the whole of the Western Line shall consist of steel rails, weighing on different portions 80 lb., 75 lb., $71\frac{1}{2}$ lb. to the yard, on ironbark sleepers similarly spaced. A great deal of the line originally laid down, and which may be called the old road, consists at present of iron rails worn at the present time to probably about 70 and $73\frac{1}{2}$ lb. per yard, laid upon ironbark sleepers placed from 3 ft. to 3 ft. 1 in. from centre to centre. This old road has been strengthened on curves, and on some other portions, by additional sleepers.

The evidence of the Chief Commissioner of Railways and of Mr. Rhodes, (Q.) 6600 to 6621; 6086 to 6122-7925, an engineer representing the Baldwin Company, and Mr. Neale (before mentioned), on the weight of rails and the maximum loads on the driving-wheels of engines which pass over them, shows that heavier engines run upon steel rails which are lighter than the lightest rails in use in New South Wales. For example, in America the Baltimore and Ohio Co.'s Railway use a 67-lb. steel rail to carry an axle load of 15 tons 14 cwt., and a total weight of engine and tender of 93 tons 6 cwt. The Eastern Railway of France employ engines carrying a load of 16 tons 2 cwt. on rails weighing from 69 to $89\frac{1}{4}$ lb. per yard. The rails are 39 feet long, and are carried on sixteen sleepers.

In America the average spacing of the sleepers is 2 feet from centre to centre, but the timber is soft and frequently of inferior quality. The ironbark sleepers used in this Colony are superior in hardness and in every other respect to the American sleepers. Sir John Fowler and Sir Benjamin Baker, most eminent engineers in England, are of opinion that a 70-lb. rail on ironbark sleepers, laid 3 feet from centre to centre, is perfectly safe for axle loads of 16 tons, provided that the ballasting is well maintained and the permanent-way in good order. It must be concluded, therefore, that, assuming the material to be good and the conditions last-named to exist, the old road of the New South Wales Railways is perfectly safe for such axle loads as are carried by the Baldwin locomotives, the weight of which amounts to 15 tons $5\frac{1}{2}$ cwt. on the passenger, and 15 tons 9 cwt. on the consolidation engines, and inference to the contrary is not to be drawn on account of the breaking of the rail which caused the recent deplorable accident near Tarana, as at the point of fracture an old flaw was discovered which extended from the base upwards for about half the depth of the rail, the existence of which was not disclosed till after the accident. Your Commissioners recognise the fact that, since their accession to office, the Railway Commissioners have done their utmost, with the means at their disposal, to effect improvement, by relaying a large portion of the lines; and it is most desirable that provision should be made to enable them to continue their efforts in this direction, which, apart from other considerations, are to be commended on economic grounds. A great deal of evidence was given with the view of showing that the platforms were altered to accommodate the Baldwin engines, but your Commissioners think that the proper conclusion to be drawn is that the alterations were made for the purpose of bringing the platforms to the standard gauge, and would have been carried out in any event; probably their completion was very properly accelerated in view of the anticipated use of the Baldwin engines. The strength of the various bridges, in regard to their capacity to carry the Baldwin engines, forms the subject of a special report by Professor Warren, from which it will be seen that some of the existing bridges and viaducts, especially the Solitary Creek bridge, on the Western Line, and the Wollondilly

Wollondilly bridges, on the Southern Line, as well as the viaduct near Wagga Wagga, are now subjected to stresses considerably in excess of that which would be regarded as safe according to the best English practice; and it is therefore satisfactory to observe that the Commissioners are taking steps to have these structures strengthened, and also that Mr. Deane, the Engineer-in-Chief for Railway Construction, has designed stronger types of timber viaducts, in view of the increased weight of the engines now used on the New South Wales Railways. The new viaduct at Glenlee (designed by Mr. Foxlee, Engineer-in-Chief for Existing Lines) is another example of the increased strength of the timber structures which has become necessary in consequence of the increased weight of engines. It is a well-known fact that the increase in the weight of locomotives, and the strengthening of bridges and viaducts to carry them safely, have been most marked during the last ten years in all parts of the world, and it is not to be supposed that structures intended to carry engines considerably lighter than those now in use should be safe to carry loads greatly in excess of those for which they were originally designed.

See Professor
Warren's
report
(page vii).

As to the general effect of the Baldwin locomotives on the permanent-way, it does not appear that the wear and tear is greater than in the case of other engines; on the contrary, their flexibility renders them less likely to spread the road than the more rigid engines of English manufacture.

AS TO THE ALLEGATIONS THAT THE BALDWIN ENGINES ARE NOT RENDERING THAT SERVICE WHICH WAS EXPECTED OF THEM.

To ascertain what was really expected of these engines it is necessary to consider the evidence of Mr. Neale and Mr. Stanger rather than the correspondence, because it will be found on reference to the latter that, in consequence presumably of alterations suggested in a letter by the Secretary to the Railway Commissioners, on the 2nd September, 1890, the Baldwin Co. declined to give a definite guarantee of speed. An extract from the Company's letter to their New South Wales agents, Messrs. Towns & Co., is in these terms:—"We have carefully considered the conditions of service for which these locomotives are intended, viz., to haul 152 to 176 gross tons of cars and load at a speed of 22 miles per hour up long grades of 136 feet per mile, combined with severe curvature, and to haul up grades of 176 feet per mile, with easier curvature, loads of 120 to 144 gross tons. We note that the sharpest curves are of 528 feet radius, but it is not stated that this is the radius of the curves in combination with the 130 feet grade. Our calculations indicate that the engines will have sufficient tractive force to haul these loads, but we prefer not to make a definite guarantee of the speed, as it is more or less dependent upon conditions of which we are not fully informed, such as the quality of the coal, the wheel-base of rolling-stock, condition of track, &c."

See letter
from Messrs.
Towns & Co.
to the Rail-
way Commis-
sioners of the
15th Dec.,
1890
(page 317).

According to Mr. Neale, the Railway Commissioners had in their letter put the required speed very high, and he states that therefore he was not at all alarmed at the refusal of the Baldwin Co. to guarantee the speed; in point of fact what it was really expected the engines would be required to do was less than the Baldwin Co. were asked to guarantee.

The results of trials of these engines will be found in appendices hereto, and they demonstrate their great hauling power and show that the passenger engines are capable, under favourable conditions, of hauling trains weighing 152 tons up a long grade of 1 in 40, at a speed of $19\frac{1}{2}$ miles an hour after the engines have settled down to their work, and when all their inertia has been eliminated. The reports also show that an average speed of about 21 miles an hour with such a load could be obtained over the whole length of the grade above referred to. It is to be remembered that the chief purpose for which the Baldwin engines were imported was to draw heavy loads over lines of railway most exceptional in their character, on which steep gradients and sharp curves are of frequent occurrence, especially on the Western line, which is stated to be more difficult to work than any of the Alpine railways.

See reports
of Messrs.
Richardson,
Stanger, and
Neale
(page 367),
Professor
Warren
(page i),
Messrs.
Pollock and
Kidd
(page 347).

In conclusion, your Commissioners have the honor to report that in their opinion the Baldwin engines are not unsuitable to the Permanent-way of the Colony, they are not defective in design, and when the objectionable tires and axles have been replaced by others of approved quality, there is no reason to doubt that they will be capable of rendering the service which was expected of them.

RECOMMENDATIONS.

RECOMMENDATIONS.

As the Baldwin Co. were, considering their reputation, very naturally relied upon to furnish engines of high class material, and as, so far, much disappointment and many failures have resulted from that reliance, your Commissioners think it would be prudent :—

- (a) That the driving axles of the Consolidation engines should be sufficiently tested to prove their suitability or otherwise for goods traffic;
- (b) That the Otis steel axles supplied by the Baldwin Co. to replace the iron axles of the bogies and tenders should also be tested;
- (c) That the system of inspection which is carried out in the case of engines constructed for this Colony in England should be adopted in all cases.

Your Commissioners have the honor to recommend :—

- (1.) That provision be made to enable the Railway Commissioners to carry out their intention with regard to the strengthening of the Wollondilly and Solitary Creek bridges, and the renewal or strengthening of the Wagga Wagga viaduct, and similar timber structures as soon as possible.
- (2.) That provision be made to enable the Railway Commissioners to continue their efforts in reballasting and relaying the necessary portions on the Western and Southern lines.
- (3.) That the twelve passenger engines be supplied with new axles and tires of suitable quality before they are restored to passenger service.

We have the honor to be,

Your Excellency's most obedient Servants,

(Signed) F. E. ROGERS,
PRESIDENT.

W. H. WARREN.
ALEXANDER BROWN.

Dated, Sydney, the 4th day of July, 1892

Trial of American Ten-wheeled Passenger Engines.

It was decided to leave Sydney with a trial train at 8.20 a.m. on Sunday, 15th May, and to commence the trials from Picton at 10.30 a.m.

The first trial to be with a load of 176 tons, up a gradient of 1 in 40, to Picton Lakes, returning tender first to Picton, and next making second trial with 152 tons again to Picton Lakes. In each of these trials the train will be set back to the north side of Picton Station, sufficiently far to enable the train to attain a speed of 20 miles per hour when passing Picton Station, this being about the ordinary speed of the regular express.

The trials up a 1 in 30 gradient to be commenced from Picton Lakes, first trial being with 120 tons, which will be taken to Hill Top; after returning tender first to Picton Lakes, the second trial up 1 in 30 gradient, with a load of 144 tons, will be made to Hill Top, thence returning tender first to Picton, arriving at about 4 p.m., turning the engine there, and arriving in Sydney at 6.8 p.m.

It is not proposed to attempt to take the quantity of coal used in each of these trials, but the quantity used between the commencement of the first trial and the completion of the day's work in Sydney will be ascertained.

In addition to the person nominated by those conducting the trials for noting the pressure of steam only, one officer of the Department, in addition to the representative of the Baldwin Company, should be allowed to ride on the engine, in order that the engineman and fireman shall be perfectly unhampered in their movements.

Professor Warren's Report on the Tests of the Baldwin Passenger Engine between Picton and Hilltop.

THE tests of the power developed by the passenger engines when hauling trains up steep gradients were made on the 1 in 40, 1 in 33, and 1 in 30 grades between Picton and Hilltop.

The object of these tests was to ascertain whether these engines were capable of doing the work which was expected of them, viz.—to haul a passenger train weighing 152 gross tons up long grades of 130 feet per mile (1 in 40) at a speed of 22 miles per hour.* The train actually used consisted of Pullman sleeping cars and first-class lavatory carriages weighing in the tests over the 1 in 40 grade, Nos. 2 and 5, 157 tons 12 cwt. 2 qr. or 5 tons 12 cwt. 2 qr. in excess of the stipulated loads.

The day was fine and the rails dry, and the conditions in every way most favourable. The speed of the train in the various tests was ascertained by observing the time taken to travel over each quarter-mile by means of stop watches specially made for this class of work, and kindly let by Mr. F. M. Allcock, Haymarket, George-street, Sydney.

The indicator diagrams were taken by Messrs. Pollock and Kidd, who were specially employed by the Railway Commissioners to do this work,† and the areas of these diagrams were accurately measured by means of a planimetre, the tractive force and the horse-power calculated. All these measurements and calculations have been made independently, and the results are recorded in the following table:—

Number of Test.	Grade.	Tractive force in pounds.	Indicated horse-power.	Total load hauled in tons.	Speed in miles per hour.	Grade resistance in pounds per ton hauled.	Train resistance in pounds per ton hauled.	Train resistance calculated by Searle's formula.	Remarks.
1	1 in 40	18,194.4	817	272	16.8	56.0	10.8	12.46	
2	1 in 40	17,801.1	899	249	18.9	56.0	15.5	14.65	
3a	1 in 33	16,313.4	884	211	20.3	67.9	9.4	17.14	Short grade engine had not settled down to its work.
3b	1 in 30	18,690.3	849	211	17.0	74.6	14.0	13.63	
4a	1 in 33	18,177.3	849.6	231	17.5	67.9	10.7	13.26	Short grade engine had no settled down to its work.
4b	1 in 30	19,647.9	771.7	231	14.7	74.6	10.4	10.93	
5	1 in 40	17,305.2	924.7	243	19.4	56.0	15.2	14.36	

The diagrams appended to this report have been selected from the forty-five taken during the various tests, and they represent in each case the work done in the cylinders when the engine was exerting its maximum horse-power for the particular test under consideration. The total resistance in pounds per ton offered by the train is found by dividing the tractive force in pounds by the load hauled in tons. The train resistance is found by subtracting the grade resistance from the total resistance.

The

* Vide letter from the Secretary of the Railway Commissioners to the Baldwin Company, September 22, 1890, p. 304.

† Vide Messrs. Pollock and Kidd's report, p. 347.

The train resistance, calculated from Searle's formula and recorded in the foregoing table, may be expressed as follows:—

- Let R = the train resistance in pounds per ton.
 „ V = the velocity of the train in miles per hour.
 „ w = the weight of the engine and tender in tons.
 „ W = the total weight of train, including the engine and tender.

Then—

$$R = 5.4 + .00V^2 + \frac{.000V^2 w^2}{W}$$

The weight of the engine and tender, including coal, water, and men on the engine, differed in the various tests in consequence of the weight of the coal burnt and the water evaporated. Thus,—in test No. 1 the weight was approximately 93 tons; in test No. 2, 91 tons; in test No. 3, 89 tons; in test No. 4, 87 tons; and in test No. 5, 85 tons.

In tests No. 3*a* and No. 4*a*, which were made on the 1 in 33 grade, and recorded in the foregoing table, the actual train resistances are considerably below those calculated from Searle's formula, which is due to the fact that the grade was short and the engine had not settled down to its proper speed; consequently, the recorded speed is greater than would have been the case if the grade had been longer. In the remaining tests the grades were long enough to completely eliminate the inertia of the train at the foot of the grade, and the actual resistances agree closely with those calculated by Searle's formula.

In tests Nos. 1 and 2, the results are somewhat lower than might have been expected, owing probably to the fact that the fire had become dead, and the short run from Picton to the fact of the grade was insufficient to ignite it.

Again the long pipes leading from the ends of the cylinder to the indicator must have caused a reduction in the pressures recorded by the indicator, and the mean effective pressures, tractive force, and horse powers recorded are probably 5 per cent. too low.

The maximum horse power recorded during the trials was 924.7, which increased by 5 per cent. is 971.

The horse power necessary to haul a train weighing 152 tons on a grade of 1 in 40 at 22 miles an hour may be calculated by the following formula:—

- Let W = the weight of the train including the engine and tender.
 „ f = the total resistance in pounds per ton.
 „ s = the speed in miles per hour.
 „ H = the horse power.

Then:—
$$H = \frac{W f s}{375} = \frac{244 \times 72 \times 22}{375} = 1030$$

This result is about 6 per cent. higher than the maximum obtained during the trials, and it is doubtful if the engines would develop this work under any circumstances whatever. As the Baldwin Company refused to guarantee the speeds, the results recorded must be considered satisfactory.

The tractive force developed in No. 4*b* test as well as in the Wallerawang trials is worthy of note, as it demonstrates the great hauling power of these engines, which appears to be quite as great as those obtained from the Baltimore and Ohio engine, which has a greater weight upon its driving-wheels. The trials demonstrate that the engines will haul the stipulated loads, but that the speed on the 1 in 40 grade with a load of 152 tons is not greater than 19½ miles an hour when the engine has settled down to its work, but the average speed on the whole length of the 1 in 40 incline is about 21 miles an hour under the most favourable conditions.

The coal and water records for these trials gave the following results:—

Consumption of coal per mile run	...	...	...	82.38 pounds
Consumption of water per mile run	...	...	...	560.78 pounds
One pound of coal evaporated	6.809	pounds of water.		

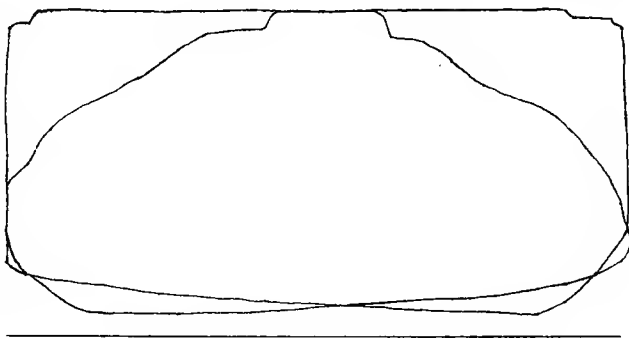
The tractive force appears to have been properly proportioned to the adhesion of the driving-wheels, and the design generally embodies the characteristic features of American practice. The engines run steadily, and take the curves without undue oscillation.

INDICATOR DIAGRAMS

TAKEN MAY 15, 1892. FROM

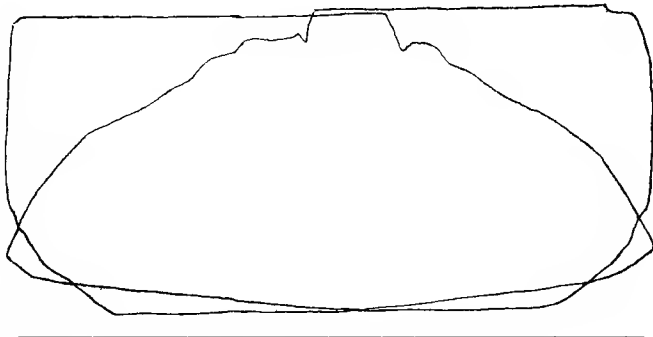
THE BALDWIN PASSENGER ENGINE. No. 447.

Scale 80lbs to an Inch.



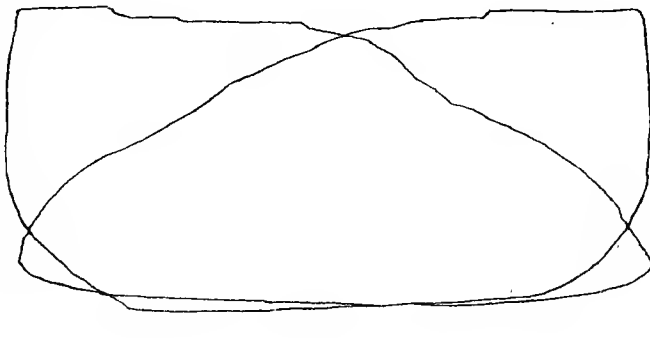
Card No. 5.
At $55\frac{5}{8}$ Miles
Grade 1 in 40
Speed 16.8 Miles
Revs. per Min 92.6
B. P. 150 lbs.
M.E.P. 106.4 lbs
I. H. P. 817

TRIAL No. 1.



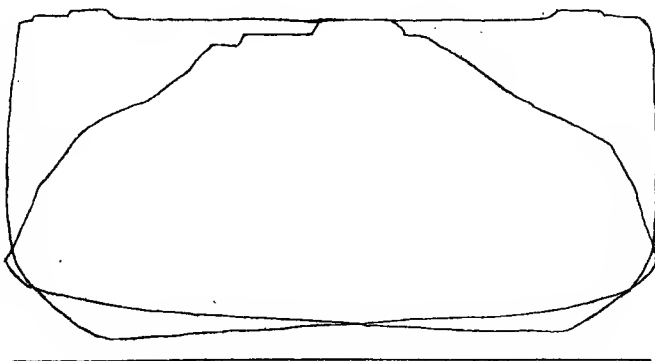
Card No. 13.
At $55\frac{3}{8}$ Miles.
Grade 1 in 40
Speed, 18.9 Miles.
Revs. per Min. 104.1
B. P. 150 lbs.
M.E.P. 104.1 lbs
I. H. P. 899

TRIAL No. 2



Card No 18
At $66\frac{3}{8}$ Miles.
Grade 1 in 33
Speed 20.3 Miles
Revs. per Min, 111.8
B. P. 150 lbs.
M.E.P. 95.4 lbs.
I. H. P. 884

TRIAL No. 3



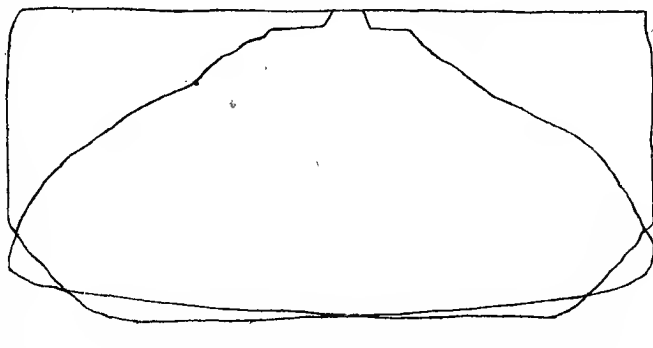
Card No. 22
At $67\frac{7}{8}$ Miles
Grade 1 in 30
Speed 17 Miles
Revs. per Min, 93.7
B. P. 155 lbs
M.E.P. 109.3 lbs.
I. H. P. 849.2

INDICATOR DIAGRAMS

TAKEN MAY 15, 1892. FROM

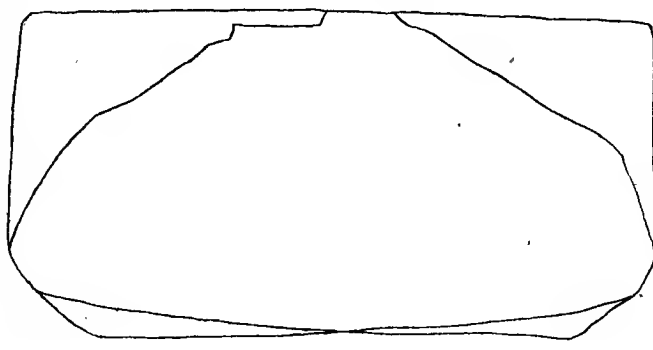
THE BALDWIN PASSENGER ENGINE No. 447

Scale 80lbs to an Inch.

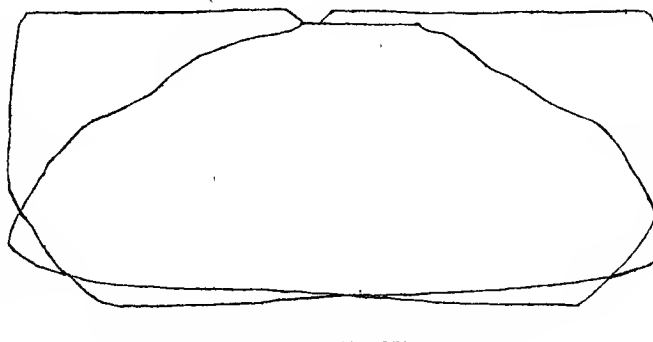


Card No 28
At 66 $\frac{5}{8}$ Miles
Grade 1 in 33
Speed 17.5 Miles
Revs per Min. 96.4
B. P. 155lbs
M. E. P. 106.3lbs.
I. H. P. 849.6

TRIAL No. 4



Card No 35
At 68 $\frac{3}{8}$ Miles
Grade 1 in 30
Speed 14.7 Miles
Revs per Min 81.0
B. P. 155lbs.
M. E. P. 114.9lbs
I. H. P. 771.7



Card No 42
At 55 $\frac{5}{8}$ Miles.
Grade 1 in 40
Speed 19.4 Miles.
Revs. per Min 110.2
B. P. 155lbs
M. E. P. 101.2lbs
I. H. P. 924.7

TRIAL No. 5

Professor Warren's Report on the Axles and Tires of the Baldwin Engines.

THE stress and strains in axles are very complex. The loads resting upon the journals while they are rotating develop stresses, which alternate between tension and compression, ultimately producing fatigue of the material. Axles.

An axle is also subjected to torsional stresses—as, for example, when running round sharp curves, or when, from unequal wear of brake blocks, the brake pressure applied to the wheels is not equally divided between them, or from insufficient lubrication between the journals and their bearings.

The shocks produced by the irregularities of the road, which cannot be entirely overcome by the action of the springs upon the engines and rolling stock, and which increase in frequency and intensity with the speed of the train, the unequal loading of axles, oscillations, and other causes, combine with those already referred to in producing fatigue of the material, and tend to commence and ultimately complete the destruction of the axle. The capacity of an axle to carry its load and to resist the other stresses developed by the causes above enumerated will depend upon its form and dimensions, and upon the physical properties of the material used in its manufacture. The sizes and proportions of the axles of the Baldwin engine are sufficient for their purpose, provided that the iron is of suitable quality. The driving-axles are exceptionally large, viz., $8\frac{1}{2}$ inches in diameter.

The failure of these axles on the bogie and tender wheels, and the results of the tensile and drop tests which were subsequently made upon them, clearly demonstrate the inferior character of the material, and their unsuitability for railway traffic.* The Baldwin Company have admitted this, and have supplied axles of Otis steel to replace the iron axles on the bogie and tender wheels, and have offered to bear the cost of replacing them.

It was stated in evidence "that the large driving axles were not made by the same firm as the bogie and tender axles, and as there was nothing to show that they were of inferior quality," they were allowed to run until recently. On the 23rd of June one of these axles was tested on supports 4 feet apart, centre to centre, and subjected to blows from a ram weighing 1 ton, falling from a height of 20 feet, the axle being reversed after each blow. The first blow produced a deflection of three-quarters of an inch; the second blow produced a deflection of seven-eighths of an inch in the reverse direction. The axle was then tested with a drop of 28 feet, which broke it, showing a coarse crystalline fracture. These results are unsatisfactory, and suggest the desirability of replacing these axles with others of suitable material. Meanwhile specimens should be cut out of the fractured axles for further tests in tension and bending. When these tests have been completed it will be possible to say whether the remaining axles may be allowed to run on goods trains, where the slower rate of speed renders them less likely to fracture. It is also suggested that the Otis steel axles supplied by the Baldwin Company should be thoroughly tested before they are again allowed to run on passenger trains.

With regard to the tires: The quality of the material in the tires is quite as important as that in the axles, and the failure of the tires on two of the passenger engines and one of the consolidation engine tender wheels, and the looseness of many of the wheels upon their axles, at once decided the Railway Commissioners in withdrawing them from service, and authorising a series of tests in order to prove their suitability or otherwise for railway traffic. Before referring to these tests it is necessary to quote the opinion of competent authorities on the quality of the material considered suitable for tires. Tires.

Sir Benjamin Baker,* probably the highest authority on this subject, tested half a dozen pairs of tires from as many leading makers at home and abroad, and submitted them to the following tests:—

1. A steady bending pressure, to ascertain the elastic resistance of the tire to collapse.
2. Two successive blows from a weight falling 5, 10, 15, 20, 25, and 30 feet, to determine the endurance of the tires under shocks and blows.
3. A steady pulling stress to ascertain the ultimate tensile strength and elongation of samples of steel cut from the tires.

The results of these tests are recorded in the following table:—

Distinguishing letter and number.	Approximate elastic resistance to collapse.	Permanent set under 40 tons in inches.	Ultimate tensile strength in tons per square inch.	Percentage of elongation in length of 5 inches per cent.	Extent of bending under falling weight.		
					After 3rd blow, in inches.	After 5th blow, in inches.	After 8th blow, in inches.
a_1	38 tons	0·05	49·50	14·0	$2\frac{3}{4}$	$6\frac{1}{2}$	$13\frac{3}{4}$
a_2	not taken	.....	49·48	14·0	$2\frac{3}{4}$	$6\frac{1}{2}$	$13\frac{3}{4}$
b_1	38 tons	0·05	46·48	18·6	3	$7\frac{1}{16}$	$15\frac{1}{4}$
b_2	not taken	.....	40·90	23·6	3	$7\frac{1}{2}$	$15\frac{1}{2}$
c_1	"	.....	44·21	8·0	$3\frac{9}{16}$	broke at 4th	.....
c_2	36 tons	0·07	42·48	5·0	$4\frac{1}{8}$	broke	.....
d_1	not taken	.....	42·51	19·6	broke	.....	.....
d_2	33 tons	0·18	37·36	5·8	broke at 2nd	.....	.....
e_1	36 tons	0·05	38·85	24·4	$3\frac{3}{4}$	broke	.....
e_2	not taken	.....	38·01	25·0	4	$10\frac{1}{2}$	$20\frac{1}{2}$
f_1	"	.....	34·67	14·5	$5\frac{5}{8}$	broke	.....
f_2	29 tons	0·60	32·25	12·0	$5\frac{1}{8}$	$11\frac{1}{2}$	$24\frac{3}{4}$

The percentages of elongation on 2 inches may be approximately obtained from the above results by multiplying the percentages of elongation on 5 inches by 1·4.

Sir Benjamin Baker states that c_1 and c_2 have a dangerously low rate of elongation, and that failure quickly resulted under the drop test. Also that d_1 and d_2 are very untrustworthy as shown by the wide difference in ultimate strength and elongation of the two tires, and by the snapping of both with a slight blow under the drop test. He also considers e_1 , e_2 , f_1 , and f_2 unsuitable for tires.

The

* See table of tests, page 312.

* Proceedings of the Institution of Civil Engineers, Vol. 67, page 358.

The tensile strength of the steel in the twelve tires ranged from 32.25 to 49.5 tons per square inch, and the extension measured on 5 inches from 5 to 25 per cent., whilst under the "drop test," one tire might fail at the second blow of a weight of 1 ton falling 10 feet, and the next only do so at the twelfth blow from the increased height of 30 feet, the respective bendings before fracture varying from no less than $\frac{1}{8}$ of an inch to 28 inches in the 3 feet tire.

Sir Benjamin Baker concludes that the strength of tire steel should probably be limited from 46 to 50 tons per square inch, but that the bending under the drop test is probably the best method of testing the endurance of the tires. Messrs. Vickers & Sons (Ltd.), well-known English makers, quote the following figures for testing their "Australia" brand tires:—

1. Drop test (for safety).—Any tire in its natural state, as laid down from the rolls (without being annealed or otherwise treated), should deflect at least one-sixth of its inside diameter—except in the case of small tires (say) of less than 3 feet internal diameter, when a deflection of one-eighth of its diameter is sufficient—without showing any sign of fracture when placed under the drop in a running position on a solid foundation of at least 10 tons, and subjected to repeated blows from a 20-cwt. "Tup" falling from heights of 10 feet, 15 feet, 20 feet, 25 feet, and upwards.
2. Tensile Test (for durability).—After the tire has stood the drop test as above a test piece $\frac{1}{4}$ square inch area and 2-inch effective length, machined cold out of the solid portion, should (without any reheating or other manipulation) show a tensile strength of not less than 47 tons per square inch, with an elongation of not less than 10 per cent. on 2 inches.

Mr. Thow, M.I.C.E., Chief Mechanical Engineer, New South Wales Government Railways specifies as follows:—

Specification for Tires.

The tires are to be made of the best Siemens-Martin or open hearth cast-steel, produced from the best hematite ore. One additional tire in every fifty is to be provided free of cost, for testing. It will be selected indiscriminately from the bulk by the Inspecting Engineer's assistant, and will be taken to represent the average quality of the fifty tires in the lot from which it may be selected. The tire selected for test is to be placed in a vertical position without being annealed, reheated, or otherwise manipulated for test purposes, on a solid metal foundation of at least 10 tons, and subjected to repeated blows from a 1 ton tup falling from a height of 10, 15, 20, and 25 feet, or upwards; and it must be flattened at least one-sixth of its diameter without showing any sign of fracture. In the case of small bogie tires of less than 3 feet external diameter a deflection equal to one-eighth of the diameter will be expected. From the tire thus treated test pieces of an original area of half a square inch (.798 diameter) and an effective length between datum points of 2 in. are to be machined cold, and tested in the presence of the Inspecting Engineer's assistant without reheating or other manipulation for purposes of the test. They must show a tensile strength which shall lie between 46 and 50 tons per square inch with an elongation of 15 per cent. and a contraction of area of 25 per cent.

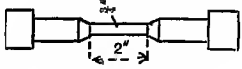
RESULTS of testing Baldwin engine tires with blows from a falling weight.

No. of Engine.	Whether Engine or Tender Wheel.	Diameter of tire in feet and inches.	Extent of hending under falling weight in inches.				Remarks.
			1st blow.	2nd blow.	3rd blow.	4th blow.	
		ft. in.	in.	in.	in.		
452	Tender	2 6 $\frac{7}{8}$	$\frac{1}{4}$	$\frac{1\frac{1}{2}}{3\frac{1}{2}}$	$\frac{1\frac{1}{2}}{3\frac{1}{2}}$	Broke ...	Each blow was from 5 ft.
448	"	2 7	$\frac{1}{4}$	Broke ...	.....	.....	1st blow, 6 ft.; 2nd blow, 10 ft.
456	Engine	4 6 $\frac{7}{8}$	$\frac{1}{4}$	" .....	.....	.....	1st blow, 5 ft.; 2nd blow, 10 ft.
.....	Tender	2 6 $\frac{7}{8}$	$\frac{1}{4}$	" .....	.....	.....	1st blow, 5 ft.; 2nd blow, 10 ft.
446	"	2 6 $\frac{7}{8}$	$\frac{1}{4}$	" .....	.....	.....	1st blow, 5 ft.; 2nd blow, 10 ft.

TENSION OR PULLING STRESS.

Test Number.	Description.	Original Dimensions.			Strain in Pounds.		Strain in Tons.	Limit of Elasticity.	Contracted Dimensions.			Contraction of Area per cent.	Elongation per cent.	Remarks.
		Breadth.	Thick-ness.	Area.	Total.	Per square inch.			Breadth.	Thick-ness.	Area.			

Results of testing specimens cut from steel tire of Tender-wheel of Engine No. 448.

														
T.T. 1	Turned specimen.	0.75" diameter.	0.44178	56,000	126,759	56.5	30.2		Not measureable.			7.5		Elongations measured on 2"
T.T. 2	" "	0.75" diameter.	0.44178	59,000	133,550	59.6	30.3		0.726 diameter.	0.4139	6.3	11.0		Elongations measured on 2"

Results of testing Messrs. Vickers & Son's tire steel.

VTS	" "	0.75" diameter.	0.44178	46,000	104,124	46.5	26.2		0.606 diameter.	0.2884	34.7	20		Elongations measured on 2"
VTS 2	" "	0.75" diameter.	0.44178	47,000	106,387	47.4	25.2		0.615 diameter.	0.2968	32.8	19		Elongations measured on 2"

The results of the drop-test on the Baldwin engine tires, and the appearance of the various fractures, show that the material is too hard and unyielding, and possesses very slight endurance under the blows of the drop hammer.

The results of the pulling test show that the tensile strength is too great, and the ductility too low and unequal; also that the material is not uniform in quality, and consequently very likely to fracture. Comparing the results of the tests on the Baldwin tires with a_1, a_2, b_1, b_2 recorded by Sir Benjamin Baker, it will be seen that the Baldwin tires are most unsuitable for railway traffic.

Professor Warren's Report on the strength and stability of the Glenlee Bridge, on the Southern Line, at 37 miles 75 chains.

THE Glenlee viaduct consists of eleven spans of 21-foot centres, and two spans of 14-foot centres at ends. Description. Each span is constructed with three compound beams of ironbark timber resting on corbels over timber trellis piers.

The compound beams consist of two 12 in. x 12 in. beams bolted together, with wedges 3 in. x 1½ in. in section between the beams and corbels at ends.

Transverse timbers, 8 in. x 9 in., are fixed to the top of the compound beams, upon which are fixed the longitudinal rail-bearers, 12 in. x 7 in. in section. Two guard timbers are provided, each 6 in. x 6 in. section. The piers consist of five piles, 12 in. x 12 in. in section, driven a considerable distance into the ground; a monkey weighing 1 ton appears to have been used for this purpose with a drop of 10 feet, the set produced by the last blow being quarter of an inch. The maximum height of the pier from ground to rail levels is 34 feet 9 inches, and the width at ground level 20 feet 7 inches. The three inner piles are carried up vertically to support the three compound beams, and the two outer piles have a batter of 1 in 6. The top headstock and bottom sill are each 12 x 12 inches in section, and the horizontal and diagonal bracing on each side of the piles are 12 x 6-inch section. The piles, headstock, sill, and bracing are securely bolted together.

The inspection of this viaduct showed that it was constructed with good ironbark timber, and Inspection. both the piles and superstructure were in good order. The maximum span of the compound beams is 21 feet 6 inches.

The viaduct was tested with one of the heaviest Consolidation engines, weighing 97 tons, and the Testing. stress produced at the centre of the beams was equivalent to a uniformly-distributed load of 4 tons per lineal foot.

Four tests were made, the first with the four driving wheels of the engine on the span, so as to produce the greatest effect, and the deflection observed was .25 inch. The second test consisted in running the engine and Pullman car at full speed over the viaduct, and the deflection observed was .33 inch, or an increase due to the dynamic effect of the live load of about 30 per cent. The third and fourth tests were made to ascertain the amount of the longitudinal and transverse oscillations during the passage of a train at full speed, and also with a full application of the brake on the bridge. The oscillations observed were exceedingly small, and in no case exceeded .02 inch.

The dead load of the superstructure including rails, sleepers, transomes, and compound beams is Calculations of the strength of the super-structure 4 ton per foot run of viaduct, producing a bending movement in the centre of the compound beams of 23 foot-tons or 276 inch-tons.

The bending movement in the centre of the compound beams produced by the loads concentrated by the four pairs of driving-wheels of the engine in their worst position is 2188 inch-tons, which, increased by 33 per cent. for dynamic effect is 2823 inch-tons. The total bending movement in the centre due to live and dead loads is, therefore, 3099 inch-tons.

The moment of resistance of the six single beams is about 10,000 inch-tons; and since the strength of a compound beam with corbels arranged, as in the Glen Lee viaduct, has been proved by the experiments made by the Railway Bridges Inquiry Commission *to be at least 50 per cent. greater than the sum of the strengths of the two beams, we have the moment of resistance of the three compound beams, at least 15,000 inch-tons. The longitudinal rail bearers will add at least 10 per cent. to this moment of resistance, making a total of 16,500 inch-tons.

Hence the factor of safety is at least

$$\frac{16,500}{3,099} = 5.3.$$

The factor of safety with the Baldwin passenger engines is at least 7.

In order to ascertain the stability of the viaduct against wind pressure, calculations have been Calculations of the stability of the viaduct against wind pressure made on the stability of the railway carriages themselves, with the result that 30 lb. per square foot of surface exposed would just be on the point of overturning the carriage. Hence 30 lb. per square foot has been taken over the viaduct and train. The weight of one span and one pier of the viaduct and its load is 52,195 lb., acting with a leverage of 9.75 ft. Hence the moment of stability is 508,892 foot-lb. The moment of wind pressure is 301,455 foot-lb.

Hence the factor of safety is $\frac{508,892}{301,455} = 1.69$. 916692/501455 The calculation takes no account of the resistance which the piles would offer to overturning and drawing out of the ground, as there never can be any tension on the piles.

The stability of the viaduct itself, without the train, with a wind pressure of 56 lb. per square foot of surface exposed, is greater than that shown by the foregoing calculations, and the factor of safety is about 2½.

The maximum retarding force producing longitudinal stress on the viaduct when an emergency Longitudinal stability. stop is made upon it, at a speed of 35 miles an hour, with a train weighing 300 tons, is well within the longitudinal stability of the viaduct, and the observed longitudinal oscillations confirm the calculations made on this point.

Hence

* Vide Report of the Railway Bridges Inquiry Commission, pages 97 and 98.

Conclusions.

Hence the viaduct is strong enough to carry safely the heaviest loads which will pass over it, and it possesses sufficient stability to safely resist the greatest hurricane which is ever likely to occur in its neighbourhood.

It is suggested that in future viaducts of this character, the spans may be increased to 24 or 25 feet, if thought desirable, and the rails laid directly upon transverse beams 10 x 6, spaced 16 inches centre to centre.

The longitudinal rail bearers may be omitted with advantage, and wedges inserted between the beams which are capable of resisting the maximum horizontal shearing stress, with slightly larger bolts at the ends.

PROFESSOR WARREN'S Report on the strength of the Bridges on the New South Wales Railways when loaded with the heaviest Baldwin engine hauling its maximum load.

IN 1884 a Royal Commission was appointed to make a diligent and full inquiry into the stability of certain iron bridges constructed on the existing lines of railway, and also of the timber approaches to the bridge over the Murrumbidgee River at Wagga Wagga.

The bridges investigated by the above Commission will be first considered in this report with regard to their capacity to carry safely the recently imported Baldwin engines, and the engines manufactured by Messrs. Beyer and Peacock, of Manchester, England.

In the appendices attached to the report of the Railway Bridges Commission on the strength of the various bridges will be found complete detailed calculations and stress diagrams, showing the strength of these bridges when loaded with the heaviest engines which existed at that time, and it is only necessary, in this report, to refer to the capacity of these bridges to carry one of the heaviest Baldwin engines when hauling its maximum load.

The calculations show that the Penrith, Menangle, Bathurst, Wellington, and Aberdeen Bridges are subjected to smaller stresses in the main girders when loaded with the Baldwin engine train than those recorded in the report of the Railway Bridges Inquiry Commission, and smaller than would be the case with two-coupled engines hauling the same load as one Baldwin engine. The cross girders of all the bridges are, however, subjected to slightly greater stresses with the Baldwin engines.

These bridges need not therefore be further referred to, as the conclusions arrived at, and the recommendations made with regard to them, apply without modification to the conditions existing with the present traffic. Such bridges as those over the Parramatta River on the Northern line, the Dubbo, and George's River Bridges, are fully up to the strength necessary to carry the increased engine and train loads which are ever likely to pass over them. They are the best designed bridges on the New South Wales Railways.

The bridges over the Solitary Creek on the Western line, and the Wollondilly Bridges on the Southern line, are nearly all constructed with spans of 60 feet, and they consequently receive their maximum stress when the loads concentrated by the wheels of one engine pass over them. These bridges have now to carry loads fully 25 per cent. greater than those for which they were tested by the Railway Bridges Inquiry Commission, and the calculations appended to their report show that the Wollondilly Bridges were stressed up to 5.4 tons per square inch in tension, also that the Solitary Creek Bridges were stressed up to 6.75 tons per square inch in tension. The joints in the flange plates of the Wollondilly Bridges are inferior to those over the Solitary Creek, so that the actual strength of these bridges may be safely taken as approximately equal.

Calculations on the strength of these bridges when loaded with the Baldwin engine train show that in the case of the Solitary Creek the tensile stress in the bottom flanges is nearly 9 tons per square inch, which result was corroborated by the evidence of Mr. H. Deane, M.I.C.E., Engineer-in-Chief for Railway Construction. The experiment on the fatigue of iron when subjected to repeated loads made by Herr Wöhler and Professor Spangenberg, and recently confirmed by Professor Bauschinger, of Munich, show that the ultimate breaking load of such iron as that used in the construction of these bridges is about 15 tons per square inch, although the statical strength may have been from 21 to 22 tons per square inch. The ultimate factor of safety is, therefore, only 1.6. Such a small factor of safety is considerably below what is considered safe for a railway bridge. The Board of Trade regulations limit the intensity of working stress in tension to 5 tons per square inch, and experienced bridge designers would adopt even a smaller working stress than this in such bridges as the Solitary Creek, where the ratio of the maximum to the minimum stress is as 1 to 0.27. It is necessary to point out that the Railway Commissioners appear to have fully realized the necessity of strengthening these bridges, and the methods explained by Mr. Foxlee in his evidence would, if adopted, render them perfectly safe to carry the maximum loads which pass over them.

The timber approaches to the bridge over the Murrumbidgee at Wagga consist of openings of 29 feet 6 inches span from centre to centre.

With the wheel loads concentrated by the recently imported consolidation engines, calculations show a factor of safety of about 4, which is not sufficient for an old viaduct like that at Wagga Wagga, although it is probably sufficient for a new viaduct constructed with the best ironbark timber. The Baldwin passenger engine or the Beyer and Peacock engine would produce smaller stresses than the consolidation engine, and there would result a correspondingly higher factor of safety. In this case, also, it is satisfactory to note that the Railway Commissioners recognize the necessity of providing stronger timber structures to carry the increased weight of locomotive engines, as illustrated in the case of the Glen Lee viaduct, which is the subject of a special report.

Mr. Deane also has designed stronger types of timber viaducts.

With regard to the bridges built since the Report of the Railway Bridges Inquiry Commission and before the Commissioners took office the following remarks are necessarily confined to the Warren Girder Bridges between Parramatta and Penrith, as the writer has not investigated the strength of the other bridges.

The

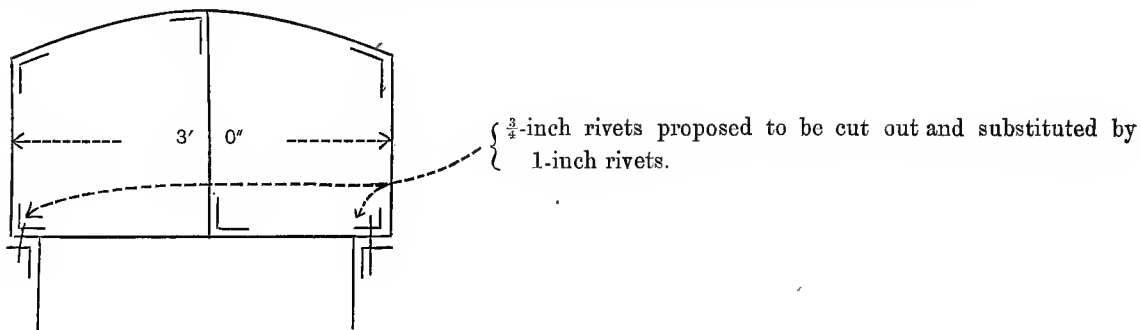
The strength of the Warren Girder Bridges referred to is fully considered in a report ordered to be printed by the Legislative Assembly, November 1, 1888.* These bridges are constructed with spans of 42 feet, and like the Solitary Creek and Wollondilly Bridges they receive their maximum stresses when one of the heaviest engines passes over them. In the calculations appended to the report referred to it will be seen that the maximum stress produced with the heaviest engines which were in use at that time occurs in the end lattice bars, and was 4·3 tons per square inch in tension, the maximum tensile stress in the bottom flanges was 3·82 tons per square inch. There are several defects in design which are considered in the report, which reduce the strength of these bridges below that which would be inferred by the figures quoted. These stresses are increased by at least 25 per cent. with the Baldwin engines, and a careful consideration of the calculations will show that they are over-stressed by this amount. It is necessary, therefore, to examine these bridges from time to time in order to ascertain if the increased stresses develop weaknesses at any part. They should also be carefully tested with one of the Baldwin consolidation engines, and the deflections compared with those recorded on page 8 of the report referred to.

With regard to the various bridges and viaducts built since the Railway Commissioners took office, the calculations and the results of testing these bridges by Mr. Foxlee which are appended to this report show that they are fully up to the standard of strength necessary to carry safely the heaviest engines which pass over them.

New South Wales Government Railways,
Sydney, 26 April, 1892.

HEREWITH I beg to enclose list of bridges constructed under the lines since the Railway Commissioners took office. In calculating the stresses the heaviest Baldwin engines have been dealt with.

With regard to Professor Warren's inquiry, as to the strengthening of Penrith Bridge, the recommendation of the Royal Commission upon Railway Bridges, which sat in 1884, to cut out the $\frac{3}{4}$ -inch rivets connecting the webs to the booms for a length of 40 feet from each abutment, and substituting 1-inch rivets has not been carried out, owing to the difficulty of doing the work satisfactorily, in consequence of the smallness of the cells in the top and bottom booms, which renders it next to impossible to hold up the rivets. This is recognised by the report itself. (See pages 92 and 93.)



But this recommendation, as well as that relating to the distribution of weight over the cross-girders, appears to refer to the line when duplicated; at present it is a single road. With regard to the bridges over Solitary Creek and the Wollondilly, the strengthening of these is under consideration. In the meantime every precaution has been taken to ensure absolute security for the traffic.

With regard to the testing of bridges and other structures: in accordance with the Commissioners' directions similar tests are invariably made to those that are made for the Board of Trade, in England, by their inspecting officers, prior to railways being authorised to be opened for traffic.

WILLIAM T. FOXLEE,
Engineer-in-Chief. .

To the Secretary for Railways.

List of Bridges of 20-ft. span and over, constructed under the line by the Railway Commissioners.

Position of Bridge.	Span.	No. of Spans.	Deck or Through Bridge.	Material used in		Actual working stresses in tons per square inch.						Tests—Average Deflection.	Remarks.
				Piers.	Super-structure.	Face Girder.		Inner Girder.		Cross Girders.			
						Top.	Bottom.	Top.	Bottom.	Top.	Bottom.		
Burren-street	ft. in.	1	Through	Brick..	Iron ..	3·95	4·63	3·08	4·58	3·5	4	in.	ft. in.
Liberty-street	51 0	1	"	"	" ..	3·86	4·55	4·06	4·80	3·5	4	·3	Cross girders, 8 0 apart.
Canterbury Road	52 6	1	"	"	" ..	3·92	4·06	3·96	4·66	3·5	4	·2	" 8 0 "
Long Cove Creek viaduct	87 10	3	Deck ..	"	" ..	4·00	4·93	..	..	4·3	5	·608	" 8 10 "
Burwood Road	67 0	1	Through	"	" ..	3·42	4·07	..	..	3·9	5	·325	" 8 0 "
Powell's Creek	37 0	1	Deck ..	"	" ..	3·06	4·00	..	..	..	..	..	" 8 0 "
Rochester-street subway ..	30 0	1	Through	"	" ..	4·00	5·00	4·01	5·01	1·5	2·9	..	
Clyde Yards	30 0	1	"	"	" ..	4·00	5·00	4·01	5·01	1·5	2·9	..	
Duck River	30 0	2	Deck ..	"	" ..	3·06	3·09	..	..	..	..	·18	Continuous.
Bunbury Curran	60 0	5	" ..	"	" ..	3·74	4·11	..	..	..	..	·22	"

* Professor Warren's report on the bridges on duplicated line between Parramatta and Penrith.

Timber Bridges.

Position of Bridge.	Span.	No. of Span.	Deck or Through Bridge.	Material used in		Factor of safety in Girders.	Tests.			
				Piers.	Super-structure.		Transverse Deflection.	Lateral Movement.	Length Movement.	
m. ch.	ft. in.						in.	in.		
35 25 Southern Line	21 0	7	Deck . .	Ironbark	Ironbark	7.5				
35 60 "	21 0	4	" ..	"	"	7.5				
36 20 "	21 0	6	" ..	"	"	7.5				
37 34 "	21 0	8	" ..	"	"	7.5				
37 75 "	21 0	11	" ..	"	"	9.57				
Menangle Approaches.....	26 0	62	" ..	"	"	7.1	.305	.07	Nil.	Up side.
43 53 Southern Line	22 6	1	" ..	"	"	6.4	.59	.....	.....
46 25 "	23 0	5	" ..	"	"	6.0				
77 46 "	26 0	6	" ..	"	"	7.0				
77 78 "	30 0	3	" ..	"	"	8.0				
39 80 "	21 0	9	" ..	"	"	7.5				
39 18 Lapstone Hill Devn...	24 0	3	" ..	"	"	7.92				
39 27 "	24 0	3	" ..	"	"	7.92				
Wallis Creek East to West Maitland.	26 0	4	" ..	"	"	7.0				

Brick Bridges.

Position of Bridge.	Span.	No. of Spans.	Rise of Arch.	Thickness of Arch.	
M. ch.	ft. in.		ft. in.	ft. in.	
17 45 Southern Line	20 0	6	5 0	1 6	All these bridges are built of brick work in cement.
19 4 "	20 0	17	5 0	1 6	
20 26 "	20 0	6	5 0	1 6	
20 30 "	20 0	17	5 0	1 6	
22 40 "	25 0	11	6 0	1 10½	
23 3 "	24 0	3	6 0	1 10½	
23 20 "	24 0	6	6 0	1 10½	
26 33 "	30 0	6	7 6	2 3	
26 73 "	30 0	6	7 6	2 3	
29 18 "	24 0	9	6 0	1 10½	

NOTE.—The intensity of the working stresses and the factors of safety are calculated for the greatest loading by the Baldwin engines.

W.T.F., 26/4/92.

BALDWIN LOCOMOTIVES INQUIRY COMMISSION.

MINUTES OF EVIDENCE.

TUESDAY, 5 APRIL, 1892.

[The Commission met at 2.30 p.m., in the Board-room, Colonial Secretary's Office.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.,

ALEXANDER BROWN, Esq., J.P.

Edward Miller Gard Eddy, A.I.C.E., Chief Commissioner of Railways, being in attendance, was interrogated by the Members of the Commission with regard to the allegations that the Baldwin locomotives were defective and unsuitable for the permanent ways of the railways of New South Wales.

ERRATA.

- Q. 2484. Read "up a grade of 1-30, &c.,"
Q. 5912. Read "And are these heavier engines running, &c.,"
Q. 5938. Read "The engine has to brake the whole train, &c."
Q. 5964. Read "It is running over the Bound Brook Road, &c."
Q. 5950. Read "efficiency" for "deficiency"
Q. 5988. Read "Philadelphia is east of Baltimore"
Q. 6146. Read "1,300 horse-power" for "1,100 horse-power"
Q. 6167. Read "1,300 horse-power" for "1,100 horse-power"
Q. 6172. Read "20 lb. horse-power" for "20 tons horse-power"
Q. 6193. The last words should read "8 tons 10 cwt. on the driving-wheel" not "6 tons 16 cwt."
Q. 6394. Remarks on Messrs. Kidd and Pollock's report apply as follows:—"Length of gradient $2\frac{1}{2}$ miles, and several curves of 16 chains radius" to "gradient of 1-40"; and "about two miles of 1-30, &c." to "gradient of 1-30."
Q. 6594. Mean speed on whole length of gradient should be "16.71 miles per hour on fourth trip," instead of "15.17 miles per hour"
Q. 6608. Read "1890 Edition" instead of "90th edition, Railway Appliances."
Q. 8391. Read "May 11" for "May 15"

sibility attaching to what they may say. Then the Commission will be able to come to a definite conclusion.

5½. *President.*] That is exactly what we desire to do, and it is the reason why we have sent for you;—we do not know who made the allegations, and we want to get these people here so that we may hear all about them. It is said that these engines are defective, and it is the duty of such persons to show that the facts are as alleged, but since we do not know who made the charges in question we have sent for you with the hope that you will be able to tell us about them, and perhaps of others also? With the exception of the name of Mr. Hoyle I do not know that of any other gentleman. There have been letters in the newspapers making charges against the engines, but I have not seen any with names attached to them. I remember one letter under the *nom de plume* of "Penrith" making all sorts of charges, but on the other hand there have been letters from a number of people who have seen the performances of the engines, and benefited by them, speaking in quite an opposite strain.

6. *Mr. Brown.*] So far as you are concerned there will be no obstacle placed in the way of the officers of the department coming forward to give evidence before the Commission? Oh, certainly not.

7. You will give them every freedom so far as you are concerned? Certainly; every information we can give the Commission we shall be glad to give it. The only thing we would ask is that the scope of the inquiry be confined as much as possible to the matters which the Commission is directed to investigate.

8. *President.*] Yes; that is quite right. Are there any letters, contracts, or any correspondence with the Baldwin Engine Company, or whoever may be the manufacturers of the locomotives, showing the Commission what kind of engine was required? Oh, yes.

9. Is there any objection to the production of these? We shall produce anything you may require after you may hear what the charges are. But first of all I think you must hear the charges. This Commission, I take it, is not charged with an explanation of, or inquiry into, the acts of the Commissioners with regard to the ordering of these locomotives, but simply to inquire into the question of the suitability or otherwise of the Baldwin engines for running upon our railways, and also as to their performing the work which they were expected to do.

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1. *President.*] Can you inform us, Mr. Eddy, what are the charges which this Commission is authorised to investigate? I am quite at a loss to know. The Railway Commissioners are waiting to see who it is that is to make the charges against the Baldwin engines, and what the charges are. All we know is that Mr. Hoyle and other Members of Parliament have made all kinds of statements with regard to them, and that these statements were made without any degree of responsibility, in the Legislative Assembly. So far as this inquiry is concerned we are waiting to see who will come forward and formulate distinct charges.

Mr. Eddy,
A.I.C.E.

5 April, 1892.

2. About what date were these statements made by Mr. Hoyle? They were made I believe at the end of August or the beginning of September last year. I was out of the Colony at the time, but I can give the Commission copies of *Hansard* containing the debates, and also the minutes thereon drawn up by the Commissioners and forwarded to the Minister. [*Mr. Eddy then retired and subsequently returned with copies of the Debates and minutes in question.*]

3. You produce these papers? Yes; they are copies of the debate of the 20th August, 1891. What happened was this. The Minister of the day, Mr. Bruce Smith, forwarded to the Commissioners this speech by Mr. Hoyle, and certain notes thereon, and the Commissioners in reply forwarded the minutes [*produced*] to the Minister, dealing with each of the statements made by Mr. Hoyle. This speech is contained in *Hansard* in extenso. There are also other minutes attached to the paper as subsequently the Minister asked for some further information, and these minutes were then sent by the Commissioners in reply to their request.

4. *Mr. Brown.*] Since that time I understand these allegations have been repeated? Yes. No doubt you have seen in the Press at different times that the Baldwin engines have been referred to in various terms.

5. *Professor Warren.*] Some people, I believe, have written letters, I do not know whether we have their names, but I have no doubt we can get them? Yes. It is not for me to suggest to the Commission the course it should take, but it appears to me that the proper method to adopt would be to get the gentlemen who made these charges in the first place to repeat them before the Commission with a sense of responsibility attaching to what they may say. Then the Commission will be able to deal with these charges definitely.

5½. *President.*] That is exactly what we desire to do, and it is the reason why we have sent for you;—we do not know who made the allegations, and we want to get these people here so that we may hear all about them. It is said that these engines are defective, and it is the duty of such persons to show that the facts are as alleged, but since we do not know who made the charges in question we have sent for you with the hope that you will be able to tell us about them, and perhaps of others also? With the exception of the name of Mr. Hoyle I do not know that of any other gentleman. There have been letters in the newspapers making charges against the engines, but I have not seen any with names attached to them. I remember one letter under the *nom de plume* of "Penrith" making all sorts of charges, but on the other hand there have been letters from a number of people who have seen the performances of the engines, and benefited by them, speaking in quite an opposite strain.

6. *Mr. Brown.*] So far as you are concerned there will be no obstacle placed in the way of the officers of the department coming forward to give evidence before the Commission? Oh, certainly not.

7. You will give them every freedom so far as you are concerned? Certainly; every information we can give the Commission we shall be glad to give it. The only thing we would ask is that the scope of the inquiry be confined as much as possible to the matters which the Commission is directed to investigate.

8. *President.*] Yes; that is quite right. Are there any letters, contracts, or any correspondence with the Baldwin Engine Company, or whoever may be the manufacturers of the locomotives, showing the Commission what kind of engine was required? Oh, yes.

9. Is there any objection to the production of these? We shall produce anything you may require after you may hear what the charges are. But first of all I think you must hear the charges. This Commission, I take it, is not charged with an explanation of, or inquiry into, the acts of the Commissioners with regard to the ordering of these locomotives, but simply to inquire into the question of the suitability or otherwise of the Baldwin engines for running upon our railways, and also as to their performing the work which they were expected to do.

Mr. Eddy,
A.I.C.E.

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10. That is exactly the point; and I think that as to the work expected from them, it would be shown by what you ordered? We shall be able to show you that, and also what they are doing to-day.
- 10½. We want to see what were ordered, and also to ascertain whether the engines are doing the work expected of them according to the orders? We will give you copies of the correspondence bearing upon these points.
11. *Mr. Brown.*] Then I understand that the Railway Commissioners will furnish us with copies of the correspondence between it and the Baldwin Engine Company? Yes.
12. *President.*] And I take it that in the event of our wanting you we shall be able to secure your presence, or at least that during the sittings we shall be able to have one of the Commissioners present, if we desire to be enlightened on any point? Certainly; there is generally one in town.

TUESDAY, 12 APRIL, 1892.

[The Commission met at 2 o'clock in the Board-room, Colonial Secretary's Office.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

ALEXANDER BROWN, Esq., J.P.

13. *President.*] I have received a letter from the agents of the Baldwin Engine Company, asking that they might be allowed to have a representative at this inquiry. By that I understand them to mean a legal representative. I would now ask if there are any other applications of the same character. Am I to understand that there are not? The members of the Commission wish it to be understood that they cannot accede to the application. So far, however, as we have any control over these proceedings, we shall permit the public to have free access to them, and the representatives of the Baldwin Company, or anyone else, can come here and listen to what is going on, and if they choose to do so send in any question they would like to have asked. Then, if it should be material to the issue, and within the scope of the inquiry, we shall in our discretion ask it from the witnesses. But to let counsel or solicitor or any advocate appear for each of the parties concerned or the different persons interested would, I think, be impracticable. In the first place I might refer to the enormous time it might take, next to the fact that this inquiry is in the interests of the public, its object being to find out, as set forth in our Commission, certain matters with regard to the Baldwin engines, and for that purpose we do not want anybody here who would cross-examine or anything of that kind. Therefore we think it better that no legal representatives of any kind whatever should appear. As I have stated, the Commissioners will be glad to put any questions which may be submitted to them, and which they think fit to be asked.
14. *Mr. Eddy.*] Do your remarks, sir, apply to the Railway Commissioners?
15. *President.*] Yes, to everyone concerned in this inquiry. The Railway Commissioners may hear the evidence, and may afterwards make any statement they wish. Of course we could not allow the Railway Commissioners to be represented unless we allowed other persons also to be represented.
16. *Mr. Eddy.*] There were applications, we understood, from outside parties. The Railway Commissioners are here practically on their trial, and we do not associate ourselves with outside parties in this matter.
17. *President.*] I cannot accept the view that the Railway Commissioners are here upon their trial. Our Commission is as follows:—[*The Commission was here read.*] Every opportunity will be given to the Railway Commissioners to say what they may desire, and to explain and defend in every way their position with regard to the Baldwin engines, to show what was expected of these engines, and what services they have rendered; but we cannot see that they should be allowed to be represented either by counsel or solicitor who might perhaps want to cross-examine witnesses. Our endeavour will be to find out what are the facts with regard to the allegations that may be made as to these locomotive engines being defective and unsuitable, and not rendering the service that was expected from them. If any questions are suggested to us we shall be only too glad to put them. So far as this Commission is concerned we wish it to be as open as possible both with regard to the legal advisers of the Railway Commissioners and to anyone else who may come here to listen to its proceedings, but we cannot allow them to take part in the inquiry.
18. *Mr. Hoyle.*] Mr. President, I should like to ask if you have decided whether you will allow any barrister or legal gentleman to sit by the side of the Railway Commissioners. I am here as the person who made the speech in Parliament. I have no legal adviser or anything of that kind. As the onus of proof will rest upon me, I do not think it would be fair for a barrister to sit by the side of the Railway Commissioners and advise them of such questions as his legal knowledge might suggest.
19. *Mr. Eddy.*] I think the Railway Commissioners stand in a very different position from that of any other persons present. Distinct and deliberate charges have been made against us, and I myself do not profess to be trained to deal with witnesses giving evidence of the nature which will perhaps be produced here; therefore I think that in ordinary justice we should be permitted to place ourselves in the hands of persons skilled in eliciting facts from hostile witnesses. We have not gone out of our way to make charges, therefore we do not ask for any protection on our own account and with regard to our own actions, but we do think we are entitled to protection against persons who have deliberately and with malice aforethought made charges against us. That is the position in which we stand.
20. *President.*] I do not think that at present at all events, Mr. Eddy, you should say that charges have been made against the Railway Commissioners with malice aforethought. As to your not being represented by legal advisers, I think you may well leave that to us in the case of witnesses whose evidence may be of the kind you point out. You may safely leave the Commission to deal with witnesses whose evidence may be of the character you anticipate. The Commission is constituted of gentlemen of common sense to whom I think you may safely leave such matters. I cannot help who may sit at the table. If Mr. Eddy has any friend here who may suggest questions to him, whether he is a lawyer or not, I cannot help that, nor do I understand that any danger is to be feared from that. I cannot prevent anyone from sitting at the table so long as he behaves himself.
21. *Mr. Hoyle.*] I presume I may question Mr. Eddy and the witnesses I shall call?
22. *Mr. Eddy.*] I am satisfied, Mr. President. You may, perhaps, later on think fit to review your decision in this matter.

23. *President.*] I do not think so. Personally I would rather let everybody concerned appear or be represented—it would take a great deal of responsibility off my shoulders; but I do not think it was intended that in an inquiry of this kind there should be counsel present to cross-examine the witnesses. We want to find out the truth, and I do not know that that would be the best way of getting at it. I thought when I received this Commission that there might be applications from the Railway Commissioners and Mr. Hoyle to be represented by counsel, and, therefore, I have not adopted this course without taking it into full consideration.

Henry Clement Hoyle, being sworn, said:—

24. Previous to giving any evidence, I desire to make an explanation to the Commission, and also to make a statement. In the first place, I desire to say that in the speech I delivered, and which is recorded in *Hansard*, I made no charges against any persons. I was particularly anxious, in consequence of certain things —

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25. *President.*] Are you giving this as evidence, or is it your opening speech? I wish to make a statement first.

26. You are now sworn to appear before us to give evidence;—do you make this statement as part of that evidence? Yes; I will make it as part of my evidence. In making the speech referred to I spoke from a pure desire to do my duty as a public man. From a long experience of fifteen years in the Railway Department of the country, and from a close study of all that has been going on in the railway system here, and from what I have read of the railway systems in other parts of the world, I was convinced that a certain order had been sent out of the Colony, the result of which was the importation of certain locomotives, known as the Baldwin locomotives. When those locomotives came here they were decidedly defective. They had material in them, the use of which was an absolute danger to the lives of the travelling public. From my knowledge of what had passed in the railway service of this Colony, and from my reading with regard to the railway systems of other countries, I knew that it was a special point in the manufacture of locomotives that the best and safest material should be put into them. From a personal examination of these engines when they arrived, I was convinced that the best material had not been used in their manufacture, but that on the other hand they contained in their construction material which was an absolute danger to the lives of the public who travelled in the trains drawn behind them. As a public man, and having had experience in this particular line of business, I considered that if I remained silent in my place as one of the people's representatives, I should be doing wrong. Believing conscientiously that I was acting in the best interests of the people of the Colony, I felt that if I had kept silent I would have been a traitor to the trust imposed in me by those who had placed me in Parliament. I was careful in my speech, to say that I made no charge against anyone, but that I believed some officer in the Railway Department had been guilty of a gross blunder, and I desired that a full investigation should be held to find out by whom the blunder had been committed, and to insure that he should be punished. This Commission is the result of my speech. I was so convinced of the propriety of the position I had taken up that I interviewed the present Premier and the Minister for Railways since that, and urged the Government to appoint a Select Committee of the Legislative Assembly. That, however, was refused on the ground that it was thought better that a Commission, such as is now appointed, should investigate this matter. I received various refusals from the late administration, but since then the present Government have come into power, and I again repeated my request that this inquiry should be held, since which the Railway Commissioners themselves, in consequence of what has appeared in the Press, and certain statements which have been made from time to time, have also asked for an inquiry on this matter. That inquiry is now, I presume, in a fair way to be held. Now, Mr. President, I propose to lay my charges before you. Mr. Eddy, when he appeared before the Commission at the last meeting, said he did not know what these charges were, and that he wanted someone to come forward and make deliberate, specific charges against these locomotives, and that persons would come here and take upon themselves the responsibility of those charges. Well, I am here to make the charges, and to take the responsibility of them, and I make them from a pure and honest belief that I am doing what I am in the best interests of the people of this country. I do this from a sense of public duty, and not from any desire to cast imputations upon the Railway Commissioners, or subject them to any unnecessary inconvenience. I have been very careful to avoid that since I have been in public life. Since it is desired that the charges should be distinctly formulated, I have drawn them up in order. The first charge I have to make is:—

- (1.) "That, in consequence of the extra width of the Baldwin passenger engines or their great length, the platforms on various parts of our lines have had to be altered."
- (2.) "That the Baldwin passenger engines are not required, and should not have been imported, as orders had already been sent out of the Colony for sufficient engines to meet all the requirements of the Railway Department, and that the money thus spent was therefore an unnecessary expenditure of public funds."

27. That is quite outside the scope of this inquiry. We are directed by our Commissions that the recently imported Baldwin engines are defective and unsuitable for the permanent-way. That is what we have to inquire into. We have nothing to do with whether these engines were an extraordinary order or not. What we have to consider is, these engines as ordered, are they defective or unsuitable or not? I understood this Commission was to inquire into the charges I made in Parliament.

28. I know nothing about what took place in Parliament; I am simply going on what our Commission says, but outside of that I cannot go. In this I think my colleagues agree with me? My third charge is:—

- (3.) "That the safety of the draw-gear will be in danger if the Baldwin passenger engines or the Baldwin consolidation goods engine draw the loads that it is stated by the Railway authorities they are intended to draw."

I desire to make it clear that in my opinion if they haul the load they are brought here to draw, they will endanger the draw-gear of the rolling stock.

29. *Mr. Eddy.*] Mr. President—Am I to understand that [that charge is admitted, surely it has nothing to do with the question, it is altogether a matter of railway management. What is advanced is that we are putting motive power to our trains that they are not strong enough to bear, that has nothing to do with the locomotives, it is altogether a question of railway management, and one I think, the Commission has nothing to do with. I take it you do not propose to go into the question of the draw-gear in the carriages and waggons. This would open up the whole question of railway administration. 30.

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30. *Mr. Hoyle.*] This is a fair question and contains a very serious charge. I say that these engines will endanger the safety of the draw-gear, that is to say the safety of the public, and if the Baldwin engines are going to do the work they were brought here to do, and thereby endanger the lives of passengers, I think this matter should be investigated. I say again that the loads these engines are going to draw will be dangerous to the draw-gear. I may refer the Commission by way of example to the Bathurst accident. That was caused by the draw-gear breaking, and the train breaking away from the engine, travelled back and came in collision with another passenger train. If these loads are put on them the safety of the gear would be endangered, and perhaps bring about a similar mishap to that referred to.

30½. *Mr. Eddy.*] I say that that is a sensational statement.

31. *Mr. Hoyle.*] I ask your ruling, Mr. President, as to whether Mr. Eddy is permitted to insult me by referring to what I have said as a sensational statement.

32. *President.*] Please confine yourselves to the bald bare question whether this charge which Mr. Hoyle seeks to make is within the scope of our inquiry.

32½. *Mr. Eddy.*] I contend it is not. Your Commission is to inquire into the defects, if any, of the Baldwin engines and their unsuitability for the permanent-way of the New South Wales Railways, and also that the engines are not accomplishing the work they were expected to accomplish. This Commission has nothing to do with the strength of the draw-gear on our carriages. So far as the draw-gear is concerned, if it had broken, every passenger train is fitted with an automatic brake, and the result would be that the train would be brought to a stop. With regard to the goods stock, every weak draw-bar has been removed by the order of the Commissioners, and stronger draw-gear supplied.

33. *President.*] The question now is, not whether you can make the draw-gear perfect or not, but whether we can go into the question of draw-gear at all.

33½. *Mr. Eddy.*] I desire to point out to you that the draw-gear is no part whatever of the Baldwin engines, and your Commission deals with the engines themselves only, and also the permanent-way of the railways of the Colony.

34. *President.*] By a majority the Commission think that this charge had better be allowed.

35. *Mr. Hoyle.*] My fourth charge. Mr. President is—

(4.) "That there are engines already in use on our railway system that are as powerful as the Baldwin passenger engines, and therefore another type of engine has been added to our stock, thus increasing the already too many types of engines in existence."

36. *Mr. Eddy.*] I must again object. This charge (No. 3) opens up the whole question of railway management.

37. *President.*] It has been decided, and I cannot hear you any more. It has been decided by a majority of the Commission to admit the charge (3).

38. *Mr. Hoyle.*] (Repeated the fourth charge). It has been said in inspired paragraphs to the Press, that we had no engines here powerful enough to do anything like what these engines can do. I say that we have engines quite powerful enough for that purpose.

39. *President.*] That is entirely outside the scope of this inquiry;—I understand you to say that the Commissioners have ordered something that is clearly unnecessary;—the question is whether they have received what they ordered or not; whether these engines were necessary or not does not matter;—that can be no charge? What I am doing is with a strong desire to help the Commission.

My next charge is—(5) "That the Baldwin passenger engines and the Baldwin consolidation goods engines are faulty in design, and that certain parts—the axles of the bogies and tenders—were dangerous, and gross neglect was shown by allowing the engines to run before the parts in question were removed."

The sixth charge is—(6) "That in consequence of the great weight of these engines (the Baldwin passenger and consolidation) the safety of the permanent-way is likely to become endangered. Our standard rail being 71 lb. per yard, whereas the above-mentioned engines were designed for an 80 lb. rail." These are all the charges that I have to make, Mr. President.

40. Now I suppose you will go on and give evidence in support of these charges? I would prefer persons being called by the Railway Commissioners, bringing their evidence to rebut these charges first.

41. *Mr. Eddy.*] Certainly not.

42. *President.*] Allegations have been made that these locomotives are defective, and those who make the allegations have to prove them, therefore you must go on and give evidence in support of your charges? Very well, I shall deal with them in the order I have stated. Now, Mr. President, my first charge is that in consequence of the extra width of the Baldwin passenger engines, or their great length, the platforms on various parts of our lines have had to be altered. I stated that these platforms had to be altered to allow these engines to pass.

43. *Mr. Brown.*] Have you yourself seen any of these platforms? Yes, I wish to say that these platforms were altered, and a great deal of expense in connection with the alterations was unnecessary.

44. *President.*] If you can show that the platforms had to be altered because of the width or length of the Baldwin engines, that is the whole point.

45. *Professor Warren.*] You could do that by simply giving the dimensions? In the first place I might state that after these engines came here the platforms were altered. No attempt was made to alter them until the Baldwin engines came to the country. When they came here, gangs of men were put on to do this work, and I am told that they worked night and day to get the platforms altered to permit these engines to pass.

46. *Mr. Brown.*] You believe you say? I can give you the numbers of the shop orders. They were 351 a. 352 a. 353 a. They were the orders issued by the Permanent Way Department.

47. *Mr. Eddy.*] The witness is speaking of what he has been told, or of what has appeared in the newspapers. Personally I know nothing of legal proceedings, but I thought that the rule was that a witness should speak of his own knowledge.

48. *President.*] I understand him to refer to certain orders that were given, and I presume they will presently be produced? These platforms were altered, and this I saw with my own eyes. I saw the Newtown platform undergoing alteration, and also that at Granville. These two I have seen myself, when the work was going on.

49. What kind of alteration was it? The brickwork was chipped away, and in the case of the Newtown station the coping was taken up and set back on to the platform, and the brickwork chipped away, to allow the

the cylinder of the engine to clear the platform. This was done to meet the case of the Baldwin engines. An engine was sent along the northern lines, with a plate bolted on to the buffer-stop—a beam across the front of the engine. A plate was bolted across this, and ran along the line as a gauge, and wherever that gauge struck the platform, it had to be altered.

50. Do you know that? I do not know it, but I can call evidence to show that it was so.

51. You must keep to the facts within your own knowledge. As to the statements you have heard, they will not be taken as evidence unless you substantiate them by the statements of someone who actually knows them? However these platforms were altered. It has been said in the Press that the alteration was made because a certain carriage in which Mr. Eddy was travelling, on a tour of inspection, struck the platforms, and it was then found that the platforms were out of gauge, and orders were issued that they should be brought into uniformity. I speak to the best of my belief when I say that the platforms were not altered until the Baldwin engines came to the country.

52. Do I understand from that that you do not know whether they were altered on account of the Baldwin engines, or that they never were altered until the arrival of those engines? They were altered after the arrival of the Baldwin engines. It was after the arrival of the engines that the order was given to alter the platforms of the suburban line. I cannot swear to how many were altered, but I can swear to the two I saw going on. The order that was given to alter these platforms was given at a time when orders had been issued for the quadruplication of the suburban line. If it is true, as asserted in the Press, that these platforms were altered to make them uniform, why were the platforms altered on the suburban line, when they had afterwards to be demolished, because every platform altered on the suburban line, with, perhaps, the exception of Granville, was afterwards pulled down.

53. I do not want to stop you, Mr. Hoyle, but only to point out to you the futility of the course you are taking. You can produce evidence to show the alterations of these platforms, but it does not necessarily show that because the platforms were altered after the Baldwin engines arrived, that consequently they were altered on account of them; neither is it any argument that these platforms were, as you say, altered, the scheme for quadruplication being in force at the very time of such alteration. You may state the fact shortly, that the alterations did not take place until after the Baldwin engines came here, and that the alterations did take place, although the whole system of the suburban railway line was at that time undergoing a change? Then I will state, as a fact, that these platforms were chipped and altered to the point where the quadruplication was going to be made, and that afterwards these alterations were destroyed, in order to make room for the new system.

54. *Professor Warren.*] Would you kindly tell me the width of the platforms or the width for the cylinder to pass? I cannot.

55. Do you not see that this could be settled at once by dimensions? That is a matter I will deal with later on. I propose to bring evidence to show the dimensions of these engines, and also that these platforms were altered to suit them. I do not swear absolutely that the alterations I have referred to were made for this particular purpose; but I swear that the platforms were altered, and since the locomotives came here, and it is yet to be proved that they were altered for these locomotives.

56. *President.*] If there is no ground for these charges, the responsibility you undertake is not very great, since you are protected from any action in giving your evidence before this Commission, and if you throw this matter out as an insinuation, and it can be proved as Professor Warren states by dimensions, it appears to me that it should be so proved? I have not power to make these measurements—I have not power to take them. I once wrote for permission to the Colonial Secretary to examine them, and he sent a letter to the Commissioners. They sent a reply stating that if I knew anything about defects in the engines they would cause inquiry to be made. One day, whilst I was in the works, I was asked by an officer by whose authority I was there, and I was told that Members of Parliament were not allowed to go into the works. I had therefore no opportunity of making these measurements.

57. I desire to give you every latitude, but I do not think it is fair that you should make insinuations about things which can be absolutely proved; they can be proved just as well as we can find out the exact measurement of this table by using a tape line;—the Baldwin engines may be badly constructed, and if we consider them to be proved to be so, we shall at once state our opinion, but I shall not allow you any more than I would allow Mr. Eddy to insinuate a thing which is capable of being proved to demonstration? The next charge is that the safety of the draw-gear will be endangered by the Baldwin engines being used. We find, from a paper laid before Parliament containing correspondence respecting the establishment of locomotive works in the Colony, certain recommendations were made. We find Mr. Neild, one of the locomotive engineers, made certain recommendations in a letter to the Railway Commissioners. After examining certain figures that were submitted by a certain firm in England, who were prepared to establish these works, he went on to show what should be the weight of a standard train. *[He proceeded to quote from the correspondence in question.]*

58. *Mr. Brown.*] Is this on the question that the Baldwin engines are defective? What I want to show is that we have heard of a standard goods train, and my contention is that if we increased that weight we would endanger the safety of the traffic.

59. *President.*] You say among other things that the locomotives are unsuitable because they are so heavy. If that is so, cannot you call these gentlemen to show that they are unsuitable on account of their weight. Surely the correspondence you have read is no evidence. An inferior officer might make a report, and if it were thought correct it might be acted upon, but if not, it would probably be torn up? He is still an officer in the place.

60. It does not follow that the Commissioners adopt his report. It would however be very strong for you if you could get a competent gentlemen to say that the engines were too heavy? Then this is not admissible.

61. How can it be, because someone not here makes a report to the Commissioners, which report does not appear to have been admitted, you cannot regard that as evidence. You can surely get the gentleman himself to come here.

62. *Professor Warren.*] What is the maximum pull which the Baldwin engines can exert? I do not know.

63. Well there is the whole question? It is not a question of what they can pull, it is a question of what they can pull without breaking the draw-gear.

64. But it seems to me we can settle this question in this way. We first find out the maximum pull exerted on the draw-gear in the ordinary work, and then whether the draw-gear is sufficient to resist the pull. That can be ascertained with absolute certainty? Yes.

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65. *President.*] We cannot take what someone has said. Call him, and if he proves it, well and good. If he comes here and makes a statement at variance with what he has written, the Commission can then question him on it.

66. *Mr. Brown.*] I understand from you that the estimated weight that these engines are to draw would break the draw-gear? The draw-gear which has been drawn by these engines has already broken. Draw-gear of additional strength has had to be procured. The draw-gear first supplied to these engines has been broken, and stronger draw-hooks have been supplied in their place.

67. *President.*] If a stronger engine, that is to say a more powerful one than hitherto used in the Colony, whether the Baldwin engines or not, were imported, would the draw-gear at present in use be necessarily suitable. Would not the draw-gear for a lighter engine be necessarily unsuitable for a heavier engine. Would they not have to put in stronger draw-gear? These engines were brought here to draw a certain load, and should have been equipped with draw-gear sufficient to draw that load. The draw-gear sent by the people who provided the engines has been broken, and additionally strong gear has had to be supplied. Again, with regard to our goods traffic, to put on a greater load than is considered to be a safe one, whatever that would be, and I was going to quote what Mr. Neild said was a safe load, would be very dangerous.

68. *Mr. Brown.*] This is not evidence, this is all argument.

69. *Professor Warren.*] How many cases do you know of in which draw-gear has been broken? I have not seen any broken, therefore I cannot enumerate the cases. That must come out from the reports kept by the Department—at least, so I understand. The witness I wish to call will be the Locomotive Superintendent at Penrith shops. I would call him to give evidence as to whether these things have or have not been broken, and with this view I would like to ask the Commission to adjourn the inquiry this week, on account of the holidays.

70. *Mr. Eddy.*] We are prepared to place every officer and man at the disposal of the Commission without the delay of a day. We would rather not have the delay of an hour. Charges have been made against the Department and are injurious to it until this matter is settled.

71. *Mr. Hoyle.*] My fifth charge, Mr. President, is that the Baldwin passenger engines and the Baldwin consolidation engines are faulty in design and contain parts, namely, the axles of the bogies and tenders, which were dangerous, and that gross neglect was shown by the Department in allowing these engines to run before the parts referred to were removed. I shall have to call witnesses to prove this, and I shall call them not from my side but from the officers of the Department. I desire to take no undue advantage of the Department, nor to put it to any inconvenience. No person directly in the Department has given me the information I have based these charges on. They are based on my own information and experience whilst in the service. I am not in league with any men of the Department. I say distinctly that the axles were defective, and I would like to produce the *Australian Star* —

72. *President.*] What has the *Australian Star* got to do with it? There was a report in the *Australian Star* of the 29th October, wherein it is stated that when one of these Baldwin engines was coming into the Sydney Station the axle of the engine broke, and had it not been for the cow-catcher, which is very heavy, probably the engine would have turned over. I do not know that, but I say the axle broke.

73. Do you yourself know of this accident? I know it from the *Australian Star*, and from the fact that I believe the axle was in the office of the Department.

74. I shall do anything I can so far as our power permits us to enable you to state your case, but I think your course would be to ask the *Australian Star* people from whom they got their information, and such person could then give his evidence, but we cannot receive here what is stated in the papers. Most outrageous things sometimes appear in the papers. How can you think it is evidence—what appeared in some newspaper?

75. *Mr. Eddy.*] We are quite prepared to admit that an axle did break, and we are prepared to admit that a number of the axles have been removed; indeed, we have removed the whole of them at the cost of the Baldwin Engine Company.

76. *President.*] Because such a thing appeared in the newspaper it is not consequently true, and cannot be taken as evidence, unless you get the person who saw it to come here and prove it. On what date was this, Mr. Eddy?

77. *Mr. Hoyle.*] It corresponds with the date in the paper.

78. *Mr. Eddy.*] Yes, I think so, the 29th October. It was arranged that every one of the bogie axles should be withdrawn, and they were replaced with steel ones at the expense of the Baldwin Engine Company.

79. *Mr. Hoyle.*] I desire to draw attention to this. That gross negligence was shown by the Department in not ascertaining before that these bogie axles were not steel, they should have ascertained that before the accident took place. This axle, I believe, was attached to the engine drawing the Melbourne express train, it broke when the train was going at a slow rate, and broke on account of excessive heating during the journey, and it was only by the interposition of Divine Providence that a great accident did not happen.

80. *Mr. Brown.*] The Commissioners admit that—is that the only one that broke?

81. *Mr. Eddy.*] That was the only one. We went into a most exhaustive test with regard to the iron of which the axles were made, and it was arranged in order to avoid the slightest risk to replace every one of the axles, and they were replaced at once, and temporarily the engines were put to goods work instead of being kept to passenger work. I would like you to understand that altogether three axles broke.

82. *President* (to witness). You say that this axle was very hot? I do not know, but I can produce evidence from an American paper to show that the gentleman who was here in charge of these engines putting them together, wrote and admitted it, and he made a statement which was not true in that letter.

83. It is perfectly shocking to my limited legal sense that what was contained in an American paper should be regarded as evidence. I think on that point I would rather take any Australian paper than an American paper? This was a scientific paper.

84. I do not know about that, I can only go by the rules of evidence? At all events the axles broke. I understand that is admitted, and having broken, I think it is evidence that they were dangerous.

85. *President.*] It is evidence that that particular axle was dangerous.

86. *Professor Warren.*] What about the other defects? The piston head is excessive in weight, and it is wearing out the cylinder. By reason of the enormous weight also of the cross head and the connecting rod

rod the slides were worn, and since these engines have been here brass liners have been put into the slides, thus creating new costs for repairs which are unjustifiable. The piston head has no relief. Most of our engines have a bar coming through the end of the cylinder gland to carry the weight of the piston-head, and thus to prevent friction in the cylinder itself. These engines have no such bar to the piston.

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87. Is not the piston-rod continued from the gland itself? No, the connecting rods are not connected with the first wheel, they are coupled with the trailing or driving wheel.

88. Have you not got a drawing, a model, or a photograph?

89. *Mr. Eddy.*] A number of plans have been prepared.

90. *Mr. Hoyle.*] I believe the principle of the engine to be good, and I believe the company could build engines just as well as any company in the world; but I am complaining that by continual friction on these cylinders the piston would have to be renewed shortly.

91. *Professor Warren.*] You mean the cylinders would have to be re-bored? Yes; and the axle-boxes are wearing into the boss of the wheel. The connecting-rod is of a very great length, and, consequently, very heavy. [*Here a photograph was produced and the witness pointed out the alleged defect.*] The wheels are made by a new process, and, in my opinion, they are dangerous; they are stamped, and not forged, as in England. They are iron stamped under a new process. They are iron wheels with steel tyres, and the driving-wheel is exceedingly light. It has defects.

92. What do you mean by defects? The fusion of the iron has not been carried out successfully,

93. *Mr. Eddy.*] What is the number of the engine you are speaking about? It was at Penrith I saw it; I did not take the number of the engine.

94. I must ask some little regard to evidence being paid. All sorts of statements are being made about these wheels being defective. I ask for the number of the engine and it cannot be given. I think that in the interests of the public there should not be such rash statements made. If there is an engine let us know the number of it.

95. *President.*] Do you say that the defect is in the wheels of all the engines? The passenger engines.

96. You say they have all that defect? They have all the defects of being too light, through being made by this process. They are too light, and, therefore, dangerous and liable to collapse.

97. *Mr. Eddy.*] He says distinctly that the engine wheels show flaws, so that at any time there may be a collapse, and an accident caused. I ask that the number of the engine be given, and that alarm should not be given to the public by a statement not capable of proof.

98. *President.*] How many engines are there?

99. *Mr. Eddy.*] Twelve.

100. *Mr. Brown.*] Any statements made upon this point may be refuted by you later on. We cannot refute unless we have some data to go upon.

101. *President.*] Could it not be arranged that some of us could see these engines for ourselves?

102. *Mr. Eddy.*] They are all over the country between here and Dubbo and could not be stopped without creating great inconvenience. Some do not come to Penrith at all.

103. *Professor Warren.*] Could you arrange for me to have a trip on one of these engines? Certainly.

104. *Professor Warren.*] You say, Mr. Hoyle, that the wheels are defective because they are made by a defective process. I want you to say what evidence you have of the defects of the wheels themselves? I believe they are defective because made by this process. In some portions of the wheels there are flaws.

105. *President.*] That is to say in the one engine you have seen and of which you do not know the number? No; I did not see the number.

106. When did you see it? Last Friday.

107. Was anyone with you? No one was with me when I was examining it.

108. Would the stationmaster at Penrith know the number? I presume the Locomotive Superintendent would. I left Sydney by the 1:30 train. I was due to arrive at 3 o'clock, and I left again by the 5:22 train.

109. *Mr. Eddy.*] Would you kindly get Mr. Hoyle to state whom he saw at the shed at Penrith? Well I was talking to the foreman, his name is Howell, but he was not with me when I was looking at that engine. He gave me no information about it.

110. *President.*] Can you tell me whether there was more than one Baldwin engine there? Yes, there were one consolidation and two passenger engines there.

111. And had they these defects you speak of? I had only time to examine one of the two passenger engines there. I found also the boss, which in my opinion is too light, had been bored larger so as to admit of the larger axle, and that a wrought-iron ring had been put on to strengthen the face of the boss, which in my opinion was a thing never done before in any locomotive. It is a thing never done; to shrink a wrought iron ring on to a boss. Again in the consolidation engine the wheel was wearing into the feed-cock, and I noticed in the engine that I looked at that the feed-cock was worn about from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch, and if that defect is not remedied soon the cock will have to be taken away and replaced.

112. Is that very material? Yes, very, if it became worn out whilst carrying you could not feed the boiler, consequently the engine would come to a stand still and become temporarily useless and have to be towed home to the shops again. Again the axle-box is wearing into the inside boss of the wheel and already a brass liner has been put in between the inside boss and the axle-box.

113. *Professor Warren.*] Do you mean sideways? Yes. This boss has been worked into, and such a defect ought not to appear for many years, certainly not as soon as this. If the axle-box works into the boss, the axle will become loose and a fault like this is most serious indeed. I have explained the weight of the piston on the cylinder, and the weight of the cross head. I propose to call evidence to show that what I state is so. In the axle-box in question there was a play of $\frac{1}{8}$ of an inch. I will show the axles were loose and linings had to be put in place, also that the whole of the iron axles were taken out and renewed with steel axles. Whether the Baldwin Engine Company are replacing them I do not know, all I desire to show is that gross negligence was exhibited by the Officer-in-Charge, when he permitted iron to be used instead of steel: The axle should be of the very best quality of steel. It was gross negligence of this gentleman not to find out the fact. In the case of the express train from Melbourne—

114. *Mr. Eddy.*] May I ask Mr. Hoyle when one of the axles broke on one of the express trains from Melbourne? I believe it was about the 29th October.

115. We are getting a number of statements that have no truth in them.

116. I must ask you to protect me against these insults.

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117. *President.*] The impression left on my mind was that this was the case referred to in the *Australian Star*, but you do not know as a fact the axle did break; you did not see it? To the best of my belief it was on the engine attached to an express train; it may have been an express train coming from the south.

118. *Mr. Eddy.*] Do I understand that the axle broke with the train with the Melbourne to Sydney express?

119. *President.*] Do you as a matter of fact state that the axle broke with the express train from Melbourne? I have been given to understand that it was an express train.

120. Whatever one does in this country, should he occupy a prominent position, will be open to comment; but it is, I think, very wrong that all the sweepings of the street should be collected here. You must get the persons who saw these things? Then we must get the reporter of the *Australian Star* who wrote the report.

121. I did not understand that the *Australian Star* stated that the axle of the train belonged to the express from Melbourne?

122. *Mr. Eddy.*] It was the axle of the train running into the Sydney Station, but not the Melbourne to Sydney express; that I admit? The fact remains that the axle did break whilst the engine was attached to the train. Again, the tubes in the boiler of the engine I saw were working loose, and that, I understand, was on account of the length of the boiler, and I will call evidence to show that. I propose to call evidence to show that these tubes have been decidedly defective since the engines came here.

123. *President.*] I am giving you all sorts of latitude, Mr. Hoyle. Every question you want asked will be put, but you are not giving evidence and should not make these statements? Considering that I made this speech in Parliament, I am taking this course for the guidance of the Commission in order to enable them to make a full and searching inquiry.

124. We will call any witness you want to substantiate these charges, but you do not substantiate them by saying that you have been told this or that? Also new reversing gear has been supplied to these engines.

125. Do you know that? I know that new reversing gear has been made, and I will call evidence to show that the work is going on to make new reversing gear for these engines. In my charges I have said these engines will not do the work they are calculated to do, and I propose to bring evidence to show that the weight on the wheels is not sufficient to secure adhesion on the rails. The cylinder is made to draw a certain load, and if the wheels under the cylinder are not sufficiently heavy they cannot draw the load on the rails.

126. *Professor Warren.*] That is a question as to the tractive force and the adhesion;—we can get all that? I wish to explain to the other members of the Commission what I meant by this. It is this way, there must be a certain adhesion on the rails to make the wheels grip. Now these wheels have been made lighter than they should have been. They were made lighter in America, to suit our lines. That I believe has been admitted in the public Press.

127. I submit that admissions in the public Press have nothing whatever to do with this matter, the engines are perfect in their design as the members of the Board will be able to see. You will have evidence to show that the engines are well proportioned.

128. The cylinder has greater power than the weight on the wheels will enable them to grip the rails.

129. *Professor Warren.*] Do you mean that there is a great excess in the cylinder power? I say that the engines are not sufficiently weighty in accordance with the rule for the power of the cylinder. The last charge I have to make is that, in consequence of the great weight of these engines the permanent-way is likely to be unsafe. Our standard of weight is only 71 lb., and if what I have said were brought about, the permanent-way would have to be relaid. That would be a source of great expenditure and one which ought not to be incurred. [*Presenting a book.*] This is what is popularly known as the "Engineer's Prayer Book"—Molesworth's pocket-book of engineering formulæ. One of these engines is weighted on the left side on the leading bogie-wheel 3 tons 9 cwt. 3 qrs., on the trailing bogie-wheel 3 tons 7 cwt. 3 qrs., on the leading coupling-wheel 7 tons 6 cwt., on the driving-wheel 8 tons, on the trailing bogie-wheel 7 tons 14 cwt. 2 qrs., making a total of 29 tons 6 cwt. 3 qrs. On the right-hand side the weight of the leading bogie-wheel is 3 tons 10 cwt., of the trailing bogie-wheel 3 tons 11 cwt. 3 qrs., the leading coupling-wheel 7 tons 4 cwt., on the driving-wheel 7 tons 9 cwt., the trailing-wheel 7 tons 4 cwt., making a total of 28 tons 18 cwt. and 3 qrs., hence leaving a difference between the two sides of 9 cwt.

130. May I ask where this information comes from, and what reliability is to be attached to these figures?

131. It does not matter we can check them.

132. You cannot correct a thing which is not in your possession.

133. How did you get the data for your calculations?

134. I got them by the power of the cylinder.

135. That has nothing to do with the weight of the engines;—I would like to know how Mr. Hoyle got these figures? I must decline to say where I got them.

136. I think I must press this question, I desired some information from the locomotive engineer the other day and I was informed the papers had disappeared from his office;—I would like to know how Mr. Hoyle got this information? I hope the Chief Commissioner does not impute that I have stolen the papers.

137. *President.*] No of course not, I think it is a pity such a thing should be said. Do you decline to say where you got this information? I want to say this that there is a recognised rule defining the weight that should be on the driving-wheels in order to make them grip, and if we make these engines the weight that their cylinders are calculated for then we will depart from the rule of all engineers as to the stability of the line required. According to all the rules of engineering the weight at present is not sufficient, but if we make it sufficient then the permanent way will be in danger.

138. Now where do you get these weights from. Where is the evidence that these are reliable data, how do I know that your figures are right? I would not press the matter, but I say that if the engines are weighted in a proper manner they should be quite equal to these weights.

139. You should have some one here to say "I have seen these engines and I have calculated the proper weights". For example, if you wanted to bring as evidence something I had said it would not do to say "I saw Mr. Rogers and he told me so", but I should have to come into the box and give evidence, on the same reasoning you cannot say these are the weights, because some one told me they were. I do not think you understand me.

140. I believe you have some data from persons whose names you cannot give—you cannot make use of that data? All I wanted to show was that if the engines were loaded up to the power of their cylinder they would be too weighty for our permanent-way.

141. *Mr. Eddy.*] How could anything which is said be of value unless the weight of the engines were put before you to demonstrate that it is too heavy for the line. This is an attack upon the Department and the evidence should be produced before the Commission to justify the statements made. It is impossible for me to say what the weight is, unless they are weighed. I say that if these engines are weighted up to the power of their cylinder to the amount they ought to carry they would be too heavy for our road, if they are not weighted up to that power then they have not sufficient weight to grip the rails.

142. *Professor Warren.*] In order to settle this we shall require drawings of the engines with the weights of the leading driving and trailing wheels, then it can be seen whether the cylinder power is in excess of the adhesion? Yes, that will be settled by experts; I presume the Commissioner will make certain inquiries; that they will order these engines to be weighed and then ascertain if what I have stated is true, and if experts think them to be correct. I say that according to the rules of all engineers these engines if properly weighted would be too heavy for the permanent-way, and will necessitate its being relaid. I say it is for the Commission to get these weights and then call experts to say whether they are too heavy or not.

143. *President.*] I do not understand that because a man makes a charge it therefore lies on the other side to refute it. There must be something in support of that charge. I am not sufficiently an engineer to know whether, from the size of the cylinders, wheels, &c., a presumption is raised against these engines; but unless the mere fact does arise from such presumption, we have nothing to show that the engines are bad. I am not aware that any privilege is given to any man to make a charge and not support it, otherwise a man might come to me and say, "You are guilty of murder; prove you are not."

144. *Professor Warren.*] Will you give us a list of the witnesses? Yes; I propose to call the Metropolitan Divisional Engineer (Mr. D. C. Simpson) relative to the widening of the platforms, the Locomotive Superintendent at Penrith, relative to the breaking of the coupling.

145. *Mr. Eddy.*] You mean Mr. Park, locomotive foreman;—you know who is in charge there? I do not. I know that Mr. Park is in the service, but in what part I could not say. I will call then Mr. H. H. Park, also Mr. Thow, relative to the bogie axles breaking, to prove these axles did break.

146. Would it not do if we admitted that the bogie axles did break, and that they were replaced by the Baldwin Engine Company.

147. *President.*] Do you want Mr. Thow for anything else? Yes.

148. I do not want to limit either side in this matter, but if both agree to admit a certain thing, then I presume it will be unnecessary to call evidence as to it? I would also like to call Mr. D. H. Neale on the question of the Baldwin engines, the breaking of the axles, and relative to the charge of neglect with reference to the material of the axle. I would also like to ask Mr. George Cowdery, late Engineer for Existing Lines, some questions.

149. *Mr. Eddy.*] Are these witnesses to be called as Mr. Hoyle's, and be cross-examined? *President.* :—They will be examined by us. Mr. Hoyle will, I have no doubt, suggest to the Commission what questions he wishes to be asked, and you will also be able to ask what questions you desire through the Commission.

150. I will also call Mr. Thomas Midelton, the late Locomotive Engineer.

151. *President* (to Mr. Eddy).] Do you wish to ask Mr. Hoyle any questions? I would like you to ask Mr. Hoyle what his experience of railway and locomotive work is.

152. What is your experience of locomotive engines, Mr. Hoyle? My experience is as follows :—First of all I was in the service of the Department for fifteen years as a mechanic, and had opportunities of observing the various locomotives in the Department, and also opportunities of reading upon this subject.

153. *Mr. Eddy.*] Were you in the erection shop? No; I was in the inter-locking department.

154. *President.*] Were you engaged in the locomotive department in any shape or form? No; but the locomotive shops and our shops were practically together. Practically we worked in the same workshops. It was simply the name that distinguished the class of work.

155. I would like to ask the witness why he did not respond to the invitation of the Commissioners to give them the information he said he had in his possession.

156. *President.*] I do not say that you are not entitled to ask this, but I do not think it is of very much weight. Suppose Mr. Hoyle had furnished all this information, perhaps he might have rendered himself liable to some proceeding,

157. Not at all. Mr. Hoyle has said that he would have been untrue to his trust if he had not acted immediately he found there was some defect in these engines. We invited Mr. Hoyle on the 3rd of August, to indicate to us any defects he might know of, so that we also might be true to our trust.

158. *President* (to Mr. Hoyle).] Did you get a copy of that letter? Yes; I got a copy of that letter, and the reason I did not give the information was because I felt I had been so discourteously treated when I asked for permission through the Colonial Secretary to go through the workshops; the Commissioners would not grant me permission; I therefore thought I had been treated discourteously.

159. Did you write a letter dated the 29th July, stating the engines were defective, of which this is a copy [*copy produced*]? Yes; I have no doubt that is the copy.

160. How many engines were there at work? If I remember rightly there were very few—I cannot say how many. It was from certain things I then heard I desired to examine these engines. I had heard that any Member of Parliament who went through the workshops, would be ordered off, and that was the reason I wrote.

161. *Mr. Eddy.*] Although the engines were due on that date, you are not prepared to state that one engine was at work? I am not prepared to say whether there were any engines working then or not.

162. It has been said that the attack on the Department was made in the Legislative Assembly on the 20th August, 1891;—will Mr. Hoyle tell me whether all the engines were at work at that time? I believe they were, and you will see that Mr. Scott, the Member for Newcastle, made certain charges against the engines at that time. He said that one of the engines had been lifted three times.

163. *President.*] Do you call him as a witness? No. I do not know whether what he says is hearsay or not; but we might call the Superintendent at Newcastle.

164. Where do you say this charge was made? In the Legislative Assembly.

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165. Then it is in *Hansard*;—is this the speech:—

"I rise to contribute my quota to the condemnation of the railway engines referred to by the honorable Member for Redfern. It is not my intention to take up the time of the House by referring in detail to the defective parts of the engines; but I wish to tell the Government that if they should decide to appoint a Select Committee, they will find the honorable Member for Redfern, Mr. Hoyle, has not painted the picture too black. The engine that was sent from Sydney north was lifted four times after she left Sydney until she came back. She was lifted, I believe, at Gosford, she was lifted at Newcastle, at Singleton, and at Werris Creek, and she was lifted again at Newcastle on the homeward journey. She came back to Newcastle with one of the eccentrics disconnected, the motion link was bent, and a new pin had to be put in. The honorable Member for Redfern forgot to refer to the defective part of the link motion, and to state that the rocking shaft had to be taken off the engine, and put into the lathe. If a Committee were appointed practical men could prove to the satisfaction of some of the keenest experts in the country that the material in these engines is not what it ought to be."

166. I suppose you know it is not unusual for hot boxes to occur on the railways;—in fact hundreds occur every week? Yes; I am quite aware of that; but I am not aware that the axles have been caused to break by that.

167. *President.*] You are referring to the case of the axle breaking; did the heating referred to cause the axle to break upon this journey to Newcastle? I did not refer to that. It was a remark of Mr. Scott's.

168. With regard to the statement made by Mr. Scott, are you in a position to state that the incidents he refers to were the cause of the axle breaking? I know nothing about that particular incident. Mr. Scott might know.

169. *Mr. Eddy.*] Perhaps you would not be surprised to hear that on the day you made the speech in Parliament, on the 20th August, that several of the engines had not been placed on the line.

170. *President.*] At the time you made the speech in Parliament were the whole of the engines on the line? No; I believe they were not. Some of the engines were, but some of the others were not, I believe. I cannot say how many were.

171. *Mr. Eddy.*] The charges the Commission are to inquire into were made on the 20th August. It appears to me that a great many of the statements made by Mr. Hoyle had reference to what he discovered last Friday at Penrith. Has he been trying to find defects in these engines recently so as to endeavour to support his original charges?

172. *President.*] I do not think I can allow that question, Mr. Eddy? I do not press it.

173. *Mr. Eddy.*] With regard to the alteration of the platforms you stated that orders were given for the work to be done and gangs of men put on day and night after the Baldwin engines had arrived, and that those orders were not in existence prior to the arrival of the Baldwin engines.

174. *President.*] No; I do not think he said that. No; I did not say that.

175. All I understood was that, inasmuch as after the arrival of the Baldwin engines he discovered that the platforms were being altered, he inferred that the alteration was necessitated by the Baldwin engines.

176. Would you kindly ask Mr. Hoyle to distinctly state what is his charge in that respect, because it is very important that it should be clear and definite?

177. Yes; what is the specific charge you made about the platforms being altered, the bricks chipped away, and so on?

178. That in consequence of the extra width of the Baldwin engines (passenger) or their great length (possibly on account of the oscillation) various parts of the platforms were altered, but I did not say that the orders were issued before or after the engines arrived.

179. *Mr. Eddy.*] You do say, however, that the alterations were made after the Baldwin engines arrived, but not that it was in consequence of the Baldwin engines being placed on the lines.

180. *President.*] Yes; that is an inference of his, but he says that he does not know when the orders for the alterations were given.

181. *Mr. Eddy.*] I would like to have this quite clear. Does Mr. Hoyle distinctly say that had not the Baldwin engines been ordered by the Commissioners the alterations of the platforms that have been made would not have been made? No; I said nothing of the kind. Mr. Eddy must know that I said nothing of the kind.

182. I do not know, though I certainly understood that you wished it to be inferred that the fact that the platforms had been altered because of the length or the width of the engines. You did say, however, that you could not prove that it was so by other evidence that the fact that platforms were altered after the engines arrived here.

183. I said that I did not know when the orders were issued, but that I did know that the platforms were altered after the engines came here.

184. But no doubt you intended to convey the impression that the alterations had been made because of the extra width of the Baldwin engines.

185. *President.*] That at all events the platforms had been chipped to suit the dimensions of the Baldwin engines.

186. *Mr. Hoyle.*] Quite so.

187. *Mr. Eddy.*] Then would you be surprised to hear that the Commissioners have been putting these defects in the platforms right ever since they came into office, and that the alterations to which you refer had nothing to do with the Baldwin engines.

188. *President.*] You can give substantive evidence of that later on, Mr. Eddy.

189. *Mr. Eddy.*] I would ask that Mr. Hoyle should be requested to state whether there are not and have not been on these lines for some years, engines as wide over the cylinders as the Baldwins ordered by the Commissioners? I am not aware that that is so. Some engines carry their cylinders higher than others. If the cylinders of an engine are high they are less likely to come into contact with platforms than they would be if the cylinders are low. If an engine is carrying its cylinder low it would be much more likely to strike the platform by reason of the shape of the platform itself, but that depends largely upon the position of the cylinders.

190. And in regard to vehicles, are you aware that before the Railway Commissioners took office a vehicle was ordered to run on these lines that is wider even than the cab of a Baldwin engine. We are charged

charged distinctly, Mr. President, as I wish to make clear to you, that the engines have been ordered and that they are unsuitable to pass the structures of the railway. In railway work we have a structure of gauge, and we have a rolling stock gauge, and by attending to certain other principles we are allowed to make our rolling stock up to what should clear our structural gauge. Mr. Hoyle has charged us with having engines put on the line that will not come within the structural gauge.

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191. *President.*] I do not object to your question, Mr. Eddy. What do you want to ask Mr. Hoyle?

192. I would like to ask him whether the cab is wider than the cylinders are; whether there is not a carriage running on the lines at this moment that is wider even than the cab of the Baldwin locomotives? I do not know whether that is so or not, but it must be understood that the cab of a locomotive has no bearing upon the question of chipping of the platforms away.

193. *Mr. Eddy.*] The question in regard to the engines and cylinders dispose of the allegations in regard to the platforms.

194. *President.*] Well, to your last answer, Mr. Eddy, Mr. Hoyle says that he does not know whether there is such a carriage or not, that is all the answer that is necessary. Then he goes on and gives some further evidence as explanatory to me, I suppose, but his answer to your question is, I do not know. Is not that so? Yes.

195. *Mr. Eddy.*] In regard to the Baltimore and Ohio rails spoken of, you told the Commission that the locomotives as though they were confined to running between Baltimore and Ohio. Do you not know that engines of this width and of much greater weight are running in all directions in America? I do not know that.

196. It is so.

197. *Mr. Hoyle.*] As a matter of fact I can amend that answer. I did not know that engines of the weight of the passenger locomotives are running, but what I stated here was that that particular engine is running on the Baltimore and Ohio railway, and that it is running on an 80-lb. rail, and I make that statement upon the authority of the *Railroad Gazette* in which I saw the facts published.

198. *Professor Warren.*] The *Railway Gazette* of what date? I will bring it to you to-morrow.

199. *President.*] You admit that you are aware that heavier engines do run in America, but you say that in that case the rails are heavier.

200. *Mr. Eddy.*] What is your authority for saying that the rails on the Baltimore and Ohio railroad are heavier than those used in this Colony? It is stated in *Pool's Manual*, and in the description given of this particular engine in the *Railroad Gazette*, the rails are described as 80-lb. rails.

201. Would you be surprised, then, to hear that we have had it on authority from America that the Baltimore and Ohio rail is a 67-lb., and not an 80-lb. rail? No; I do not know that, and I do not see how this can be evidence.

202. I am prepared to put it in evidence, and in that way to prove that it is so.

203. At all events, you do not know what the weight of the rails between Baltimore and Ohio is except from what you have read in the *Railroad Gazette*? As I stated, the *Railway Gazette* distinctly says that they are 80-lb. rails.

204. *Mr. Eddy.*] In America there is an association or a committee called the Master Mechanics' Association. The Master Mechanic of America holds a similar position to the Locomotive Superintendent of English Railways, and the Master Mechanics' Association is a very important body, and deals with very important questions in regard to the general administration of locomotive departments of the different States. I would like to ask if Mr. Hoyle is aware that that body has considered the question of what weight in locomotives rails of a certain weight bear? I am aware of the existence of such a body, but I am not aware that they have taken this matter into special consideration, or, at all events, of any report that they have drawn up upon it.

205. Therefore I take it that you are not aware that they consider it safe for a rail of over 60 lb. to bear a locomotive of 16 tons?

206. *Professor Warren.*] What weight?

207. *Mr. Hoyle.*] I do not know that such a weight has ever been put on the lines in America, but I do know that it is against all rules of railway management.

208. *Mr. Brown.*] Do you know that as far back as 1891 that an experiment was made between New York and East Buffalo, and that on that occasion a distance of 430 miles was performed in 425 minutes, that the weight of the engine was, with full tenders, 100 tons, and the total weight of the train was 230 tons, showing that for speed and weight in a long distance journey the record had been surpassed, and the engines run were similar to the Baldwin engines? No; I have not heard of that.

209. *Mr. Eddy.*] Of course the Commissioners have a great amount of responsibility and anxiety in connection with any new departure made by them in a question of this kind; and as Mr. Hoyle has stated what ought and what ought not to be done, I should like to ask him whether he would be surprised to hear that I had consulted Sir Benjamin Baker and Sir John Fowler, two of the greatest engineers in England, as to whether a 70-lb. rail, such as they know exists here, would bear a locomotive weighing 16 tons and a pair of drivers.

210. *President.*] How can he know unless you have told him?

211. *Mr. Hoyle.*] I would like to ask Mr. Eddy why, under those circumstances, he is laying down 80-lb. rails on the lines in New South Wales? In that case we prefer to pay £1 to save £5. It has been stated that a 60-lb. rail is the standard rail. Is not Mr. Hoyle aware that since the Commissioners came into office for the purposes of economy, and for other purposes, they have adopted an 80-lb. rail?

212. I am aware that you have done it on the suburban lines?

213. And on all lines. The rails throughout the Colony are being altered to 80-lb. rails.

214. I am aware that 80-lb. rails have been laid on the suburban lines, but I am not aware that 80-lb. rails are being laid throughout the Colony, and if they are I shall certainly have something to say about it on the question of unjustifiable expenditure.

215. Mr. Hoyle has stated that unless the alteration in the platforms was made to accommodate the Baldwin locomotive the order was given unnecessarily, at least so far as the suburban lines were concerned, inasmuch as it had previously been decided to quadruple them. I should like to ask how, if that alteration had not been made, the engines would have run along the suburban lines?

216. *President.*] As I understand Mr. Hoyle, he says that there was never any bother before the Baldwin engines arrived. He says he never knew of the platforms being altered before the Baldwin engines

- Mr. Hoyle, M.P.
12 April, 1892.
- engines arrived, but that they have been altered since those engines came to the Colony. He does not say positively as a fact that it was to accommodate the Baldwin engines that the platforms were altered, but he asks that it should be inferred from the time that the alteration was made that it was made for that purpose.
217. *Professor Warren.*] He also states that the Newtown platform was altered, and afterwards removed altogether, for the purpose of making a fresh station.
218. *Mr. Hoyle.*] I should like the President to ask how it was that the Railway Commissioners thought it justifiable to alter these platforms if they had previously decided to demolish them.
219. *President.*] Questions of that nature may be put to the Railway Commissioners at a later stage of the inquiry.
220. *Mr. Eddy.*] With regard to the draw-gear of the engines to which Mr. Hoyle has referred as having been changed, does he know that that change was made at once, because the Baldwin people had unfortunately overlooked a detail in the specifications, and that the draw-gear was changed at their expense, and not because any mistake had been made in the designs.
221. *Mr. Hoyle.*] It is utterly impossible for me, or any man outside the Railway Commissioners, to know what was done elsewhere. All I can say is that it was a defect, and so much has been admitted by Mr. Eddy.
222. *Mr. Eddy.*] Mr. Hoyle appears to have an intimate knowledge of the details of railway management, that one would have thought that he would have known of an important fact such as this.
223. *President* (to Mr. Eddy).] If you can prove that it demolishes that part of the charge up to the present; however, an allegation has been made that the drawing-gear has been altered, and from that fact it is sought to draw a hostile inference. It is useless, however, for you to ask Mr. Hoyle if he knows the reason for which you altered the draw-gear was so-and-so. He cannot tell you, but if you can prove the reason for which the draw-gear was altered when you give your evidence that settles the whole thing.
224. *Mr. Eddy.*] With regard to the engines themselves, Mr. Hoyle has made all kinds of theoretical suggestions. I would like to ask him whether the best answer to all that he has stated would not be a statement as to the practical work that these engines are doing every day. He talks of the engines not being properly adjusted and of their slipping? Would evidence to the effect that these engines slip less than any other on the New South Wales Railways be the best answer to this.
225. *President.*] Have you any further questions to suggest to us to put to Mr. Hoyle? I do not wish to ask any more questions.
226. *Mr. Brown* (to Mr. Hoyle).] You have never been in America have you? No.
227. Would you be surprised to learn that half the railways in the world are in America? I am quite aware of that.
228. And that the Baldwin Locomotive Company is one of the largest manufacturers in the world? Yes, and one of the best.
229. *Mr. Eddy.*] I would like to ask one more question. Mr. Hoyle made some allusion to the draw-gear of the rolling-stock and stated that hauling power of the locomotive was in excess of the strength of the draw-gear.
230. *President.*] Yes, he did.
231. I should feel obliged if you would ask Mr. Hoyle if he is not aware that the whole of the rolling-stock of the passenger department is fitted with an automatic brake, and if the draw-gear did break the only consequence would be that the train would be brought to a standstill? Yes; I am aware of that and I am sorry in giving my evidence I omitted to draw a sufficiently marked distinction between the goods and passenger engines. If the passenger draw-gear did break away no doubt the result would be what Mr. Eddy has said, but if the draw-gear on a goods train broke the train not being fitted with automatic air brakes it would be very likely to lead to a serious accident.
232. *President.*] In other words that there would be danger to any trains not fitted with automatic brakes if the draw-gear did happen to give way? Yes.

WEDNESDAY, 13 APRIL, 1892.

[The Commissioners met at 2 o'clock in the Board-room, Colonial Secretary's Office.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

ALEXANDER BROWN, Esq., J.P.

David Carnegie Simpson, being sworn, said:—I am divisional engineer for the Metropolitan district.

- Mr. D. C. Simpson.
13 April, 1892.
233. *President.*] Do you know anything about the alteration of the platforms, more especially the suburban platforms? Yes, sir.
234. Can you tell me when these alterations were made? They began about June, 1891.
235. Was that when the Baldwin engines had been received in this Colony? Well, I cannot tell you the exact date of the arrival of the Baldwin engines.
236. Can you tell us as a fact whether that work was done before or after the Baldwin engines arrived here? Before.
237. Were the alterations in the platform, such as I understand the chipping away of the brick-work and alterations to the coping stones, made in consequence of the Baldwin engines owing to their length or breadth or dimensions generally because they (the Baldwin engines) could not otherwise pursue the traffic? The question of the adjustment of the railways to the platforms standard gauge had been under consideration for some time, and had then been decided upon.
238. Was it on account of these engines in particular? No; for the rolling stock generally.
239. Then it was not in consequence of the Baldwin engines only? No; it was on account of the Baldwin engines and other rolling stock in the Colony.
240. Can you tell us whether it was done especially on account of the Baldwin engines? No; I was simply under instructions at the time, and I know the work was done.
241. Who would know about this matter? The Engineer-in-Chief, Mr. Foxley.

242. *Professor Warren.*] Did you alter the Newtown platform? Yes; the Newtown platform was altered.
243. Did you know at the time that it was subsequently to be removed, and a new station to be built somewhere else? I had nothing to do with it; I was simply in charge of the existing line: I had nothing to do with the design.
244. *President.*] Do you know at the time the alterations were about to be made, entirely new stations were about to be built? I knew of the alterations, but I did not know the exact site where the buildings were to be erected.
245. *Professor Warren.*] Do you know the width of the platforms before you altered them, and the width of the altered platform? I could give the case of Newtown Station—it went, I believe, from 0 to 1½ inches its whole length.
246. What I wanted was the original width between the walls? I have had no time to prepare my information, but I could get it. I only got my notice to appear at this Commission at 10 o'clock last night. I should have prepared my answers if I had known the line of examination that would be taken.
247. *Mr. Eddy* (to the President).] If you would ask the witness at what gauge he put it you would then arrive at the figures you require.
248. *Mr. Hoyle.*] I must object to any prompting on the part of the Commissioner. I have some questions to ask him, and I think as he is an engineer of some repute, he might be left without prompting.
249. *President.*] I do not think that this is prompting. I understand the Chief Commissioner for Railways did not intend to prompt, but only to suggest a question. He may put a question in a more intelligible way than I would, because I do not know anything of engines or railway lines. To what gauge did you alter these respectively—the line of the platform? They were altered to 5 feet 1 inch from the centre of the road.
250. *President.*] If there are any questions you would like to put, they must be considered as put through me. If there are any questions which I think you ought not to put, then I shall stop you.
251. *Mr. Hoyle.*] The witness has said that the work on the suburban line was done in June last. Will the witness swear that the alterations to the platforms on suburban line were done and completed in June last? No, I cannot swear that; because I was absent on leave during the month of June, and during my absence the work was carried out.
252. *President.*] When did you come back? I came back on the 27th June.
253. Was it begun in June? Yes, and it was going on for some time. We had to see to it. The object was to bring the platforms to the standard gauge.
254. Were they not at a uniform gauge before? Oh, no; the line was built before Mr. Whitton's advent here, so that the gauges are of different widths
255. I understand the gauge to be a fixed distance from the middle of the line to the flush, the vertical flush of the platform? Yes.
256. *Mr. Hoyle.*] I would like to ask the witness whether in making arrangements about the gauge he would swear that the rails had not been moved in those cases where the necessity was to alter the platform:—will you swear that the distance in the 6-foot was not more than 6 feet, that the alterations could not have been made by moving the rail back? We would use the most expedient way, if necessary to cut the platform away we would do it.
257. Will you swear that the rail was not too close to the platform, and that by the slewing the rail back the alteration of the platform would have been obviated? I will not swear to any exact dimensions. It would not be less than 6 feet.
258. Do I understand that the witness does not know what the dimensions were when these alterations were brought about? I have measurements of all the platforms before and after the alterations.
259. Did you ever hear in your capacity as engineer of any of the vehicles being used in the traffic striking the platforms previous to these alterations being made;—will you swear that you ever heard that any of the vehicles used in the traffic ever did strike the suburban platform? I never heard of any vehicles striking.
260. Will you be prepared to produce the shop orders issued when instructions were given to carry out this work?
261. *Mr. Eddy* (to the President).] Is it not rather irregular to have this cross-examination on his own witness by Mr. Hoyle?
262. *President.*] It is put in the form of cross-examination, I admit, regarding the witness as Mr. Hoyle's own witness, but he has only to alter the question a little and ask him if he can to produce the shop orders. It is a matter of manner rather than of words. (To Mr. Hoyle): Have you got the shop orders for the alterations? Which are they?
263. *Mr. Hoyle.*] In the locomotive department you have shop-orders, but in your department each job has a number. I want to know the numbers for all the work done in your district authorising the work to be commenced, and I also want to know when the work was commenced. Will you place these papers before the Commission? I think that is for Mr. Eddy to say.
264. *Mr. Eddy.*] Would it not be more convenient for the Commission, rather than going into details that whenever a platform was altered, to have the particular facts placed before you with regard to the alterations, and the decision of the Commission that certain alterations should be carried out as rapidly as possible.
265. *President.*] I do not know what Mr. Hoyle may want these orders for, but I suppose these orders are particular orders to do certain work. I do not know whether they are called shop orders or not.
266. *Mr. Eddy.*] It is troubling the Commission with a lot of unnecessary detail.
267. *President.*] If Mr. Hoyle thinks it right to have these orders, it would not be correct for the Commission to stop them. If these shop orders are merely a preface to something else it will be better to have them. I take it that Mr. Hoyle intends to show that these alterations were made in consequence of the Baldwin engines.
268. *Mr. Hoyle.*] The reason I am asking these orders is that I do not intend to bring any witnesses here other than the officers of the Department, I have no communication with the men in the railway service. My charge will be made on very broad grounds. I had no communication with the men, and I ask this question because it is only through the officers of the Department that I desire to prove my case.
269. *President.*] I do not know what the shop orders are, and I therefore cannot express an opinion as to their admissibility.

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270. *Mr. Hoyle* [to witness.] Will you swear that it was not your belief that the alterations were made, when they were made to meet the necessities of the Baldwin engines?
271. *President.* His belief has nothing to do with the matter. Supposing that some orders were given by the head of a department, and supposing his clerk forms an opinion as to why that order is given, is that opinion to prevail, although it may be quite erroneous? No matter about the opinion, what you want to know is what was done.
272. *Mr. Hoyle.* Are you aware than when the quadruplication was made between Eveleigh and Sydney, that on what is now the eastern outline a retaining wall stood before the alteration was made.
273. *Professor Warren.* What are you referring to?
274. *Mr. Hoyle.* I am referring to the Eveleigh Station;—are you aware that when the line was laid down a wall was built up on the eastern side, making, in fact, the eastern side of the new platform? Yes.
275. Will you swear that wall was not pulled down and another erected in its place? I have nothing to do with it.
276. Will you swear that that wall was not pulled down? I do not understand you.
277. *President.* Ask him if he knows it as a fact.
278. *Mr. Hoyle.* Do you know then, as a fact, that the eastern wall, after being first erected, was subsequently pulled down and re-built? I am not aware of it.
279. Were you aware that when the work of quadrupling the line was ordered to be carried out, you being engineer of the district, that the platforms which had been altered in the suburban line were demolished? I had nothing whatever to do with the site of the new building, I was simply in charge of the existing works.
280. How many of the platforms were altered? You must give me time to prepare an answer—I did not know the question would be put, or I would have supplied the information.
281. *Professor Warren.* If Mr. Simpson will supply us with a list of the platforms, and details of the alterations performed after that ought to be sufficient.
282. *Mr. Eddy.* How much did it cost for altering the platforms at Newtown?
283. *President.* Do you mean chipping away bricks and coping? Yes.
284. In the case of Newtown it was about £10.
285. *Mr. Brown.* How much did it cost in the suburban area? I do not know, but I will supply the information.
286. *Mr. Hoyle.* Was the Granville platform altered? Yes, it was altered.
287. There are four platforms, I believe? There are three really, but they answer the purposes of the four roads; so far as my memory is concerned, I believe they were all altered.
288. *Mr. Eddy.* An answer was given in Parliament in regard to these alterations of platforms, which answer has been characterised in a speech I saw, as a deliberate falsehood. I would like to ask the witness whether he, in conjunction with the Engineer-in-Chief, made the estimate for bringing the platforms to the standard gauge, and whether he provided the information for the Railway Commission, in conjunction with the Engineer-in-Chief, but approximately the cost would be £50.
289. *President.* Is that so? Yes, that is so.
290. *Mr. Brown.* What I understand from you, Mr. Simpson, is this—that you cannot give any information to the Commission with regard to the alterations, from your own knowledge; you only know that they were altered in connection with the general vehicular traffic, and not particularly with regard—so far as you know—for the purposes of the Baldwin engines.
291. *Professor Warren.* They were altered for the purposes of uniformity, and to bring everything to a standard gauge? Yes.
292. *Mr. Hoyle.* I would like now to have the Chief Commissioner sworn; I have some questions to ask him on this particular letter—I would like to have him sworn in.
293. *Mr. Eddy.* I do not think that would be quite fair, and I hope the Commission will not fall in with that proposal. I think that before I give my evidence I should hear the charges, and that we should have all the evidence that is to be produced against the Commissioners.
294. *President.* I wish you to understand this—it appears that Mr. Hoyle desires you to be called to substantiate some ground of charge, just as if you were in a Court as one of his witnesses, so you may answer these questions, and the Commission may call you again.
295. *Mr. Eddy.* I am prepared to give evidence as a witness, but not to be subjected to cross-examination.
296. *President.* The questions to be put to you are to be put through me, but I shall refrain from repeating them, in order to save time.

Edward Miller Gard Eddy, being sworn, said:—

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297. I am Chief Commissioner on the Railways of New South Wales.
298. *Mr. Hoyle.* I wish to ask you is it customary for you to hold conferences with the officers on any matters connected with the Department. Is it the custom of the Commissioners to call their officers together in conference when anything is going to be done in connection with the management of the railways?
299. *Mr. Eddy.* We hold conferences with regard to the management of the railways, and some times special meetings are held with regard to proposed works; it depends upon what we consider is the importance of the matter.
300. *Mr. Hoyle.* Had any conferences relative to the importation of these engines been held.
301. *President.* Had any conference been held by the Commission with its officers relative to the importation of the Baldwin engines? Yes, there was a conference held.
302. *Mr. Hoyle.* Was there any objection raised by any of the officers called together at that conference relative to the importation of these engines? No.
303. *Mr. Hoyle.* I wish to ask the Chief Commissioner did he make a speech on the 21st of January last at a meeting in connection with the Railway Ambulance Corps. I will quote part of the speech, and ask him if he used those words.
304. *President.* You can ask him if in a speech he delivered before the Ambulance Corps did he say such and such words.

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305. *Mr. Hoyle.*] Then did you in the speech delivered at the Railway Institute, on or about the 20th of January last, say the following words:—"One question is that of the Baldwin engines—the ten-wheeled American engines. All kinds of stories were current as to mistakes in their design, the alterations of the line, and so on, and it was well the facts should be known. The engines had no mistake in their design; they were fitted as they were intended to be with regard to their size, and the alterations made upon the lines had no bearing upon the Baldwin engines. Before the Baldwin engines were ordered the Commissioners found, on making their inspection trips over the lines that through various mishaps the works were in many places out of gauge, that in maintenance or construction of the lines the rails had been shifted in towards the fixed structure, causing the original standard of Mr. Whitton to be encroached upon. They had simply given orders for everything to be brought back to gauge. When the Baldwin engines were ordered, as they were to be made to the maximum size, the Commissioners had directed that this work should be pushed on, and it was completed by their arrival. The necessity was put down to the new engines. There was an erroneous idea that the cost of this work had been something great, but the total expenditure had been for altering stations and platforms, £2,478, and for slewing lines, £112—a total of £2,590 for the whole of the railways of the Colony." I would ask Mr. Eddy did he use these words—is that a substantially correct report of what you said?

306. *Mr. Eddy.*] I would respectfully decline to answer a question of that kind. It is too far back for me to remember the words I used in January last. If Mr. Hoyle will divide the points he wished me to answer, I shall do what I can to reply to them.

307. *President* (to Mr. Hoyle).] You will state particular parts of the speech you wish to refer to.

308. *Mr. Hoyle.*] Is it a fact that in the maintenance or construction of the lines the rails had moved in towards the fixed structures, which was it. Were the rails put back in their proper places or were the platforms altered?

309. *President.*] It is said Mr. Eddy in your speech the rails had been shifted;—what have you to say as to that? I would have been more correctly reported if I had said in this speech that either the rails in the maintenance had been moved nearer to the fixed structure or the structures had been erected too close to the rails. In some cases it arose in the former way, and in other cases in the latter.

310. *Mr. Hoyle.*] Were the platforms altered or the rails put back where they ought to have been? In some cases it was found possible to slew the rails out from the structure, in others it was found impossible to do so, and therefore it was more desirable to chip the platform, which in many instances was an exceedingly small thing, and in some cases only one end of the platform was out of gauge. I might mention a great difficulty, for instance, at Petersham, where the station was erected in such a manner that there was not a proper clearance. It was always a tie upon the railway, and that has been known for years, and has curtailed the working power. It was a most difficult thing to manage, and the only way of pulling things to a standard gauge was to reduce the 6 ft. way to 5 ft. 9 in. It was known for years that that place was inches out of position.

311. *Professor Warren.*] It was built so? Yes; it was built so. The majority of the cases where these difficulties have arisen are where the structures have been built since the railways were opened, and have not been built to gauge. I have with me a minute which was drawn up on the subject of the difficulties experienced owing to the want of a standard gauge in working the railways. The minute is dated the 8th of April, 1892, and in it it is stated that "Owing to the want of a standard gauge any work carried out by the divisional engineers was built as they individually thought best, as was discovered when the Mann car made a trial-trip to Albury, on which I went. Many platforms were found to be very much within the gauge, and these were in all cases, except one, those that had been constructed by the Existing Lines Department. Petersham was one of these, the platform walls of which only gave a clearance of $3\frac{1}{2}$ in. x 2 in., and to enable the car to pass with safety the roads had to be pulled over, so that there is only 5 ft. 9 in. in the 6 ft.; and the same thing happened at Croydon, Menangle, Douglas Park, and Picton, where alterations had to be made to the platforms; and it might here be mentioned that between Sydney and Albury the height of platforms varied 1 ft. $1\frac{3}{4}$ in., and the distance from rail varied $7\frac{1}{4}$ in." With reference to the overbridges, these were so low that it was necessary to keep a gauge at some bridges to prevent fettlers packing the road too high. It is that we have been trying to put right.

312. *Mr. Hoyle.*] I would like to know how many platforms the carriage in which Mr. Eddy was riding when he made his first inspection struck against? Not one.

313. *Mr. Hoyle.*] Did it come in contact with any one of them? No; not one. The carriage had been reduced some years before—a piece having been cut out of it in order to make it run on the line. I believe that in one of the series of inspections an inspector was knocked off the step of the carriage at the end of the train by a lamp-post which had been put too near the line. In going up a short branch near Newcastle the side of the carriage was slightly damaged. When we were coming down the line cautiously at one place, we could not get on till we had cut down a large part of a gate post in order to get past. Coming from the Mountains also we came into collision with a water column, which was too close to the line.

314. *Mr. Hoyle.*] Was it a fact, then, that the carriage in which you were did not strike any of the platforms? It did not come prominently before me in that way.

315. *Mr. Hoyle.*] Even if your carriage did not strike any of the platforms, did you not think that, nevertheless, they were unsafe, and that it was unsafe to run carriages on that line? Anything that happened to our carriage had no bearing whatever on this question. The question was under consideration in 1879, and here is a list of places that were under review at that time, it was reported that the platform at Clarence Siding would require 3-inch cutting; that at Bowenfels, the road in front of the platform, would require slewing 5 inches; that the platform at Eskbank would require 3 inches cutting off; that the road in front of the platform at Wallerawang would require slewing 3 inches; that at Rydal, the road in front of the station would require slewing $2\frac{1}{2}$ inches; at Tarana, the road in front of the platform required slewing 2 inches; and that in front of the station at Macquarie Plains required slewing $4\frac{1}{2}$ inches; at Raglan, also, the road required slewing $4\frac{1}{2}$ inches; at Bathurst, the road in front of the platform required slewing 3 inches, and so also with Newbridge and Blayney. These were a few of the cases in question, and a lot of the work was done; but in thinking out our work we found that the line was still materially out of gauge. Here is a *précis* made for the late Commissioner before we took office, pointing out how the whole thing was wrong, and that rolling stock could not be properly utilised in consequence of not knowing what the gauge was. The memo. says: "The first notice I have been able

to

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to obtain, and it was only unearthed at Existing Lines, after much inquiry and trouble, is a minute by Mr. Scott, asking Mr. Cowdery for the height of the bridges at Erskinvile Road and Newtown, and if the road in the former place would bear lowering." Then as to Petersham, it says: "Locomotive Engineer minuted that heretofore the Petersham platform had been our great difficulty, but he found by the diagram that there were in the north platforms which projected at top $3\frac{1}{2}$ inches more than Petersham, the available width being thus reduced by 7 inches." These quotations were taken from a *précis* of papers up to 1888. That was just before we came into office, and certain engines were not allowed to run on certain parts of the line because they were too wide. Here is one quotation: "Date, April, 1889. Mr. Halligan writes Engineer for Existing Lines (also referring to a previous communication in 1888), pointing out that the large type of engines in use in the Sydney district could not be run on the Northern Line." Again, "December, 1890. The Commissioners inquired into the reason for the apparently unnecessary assistant mileage on the Northern Mail Train. Mr. Stanger replied that it is due to the platforms being too narrow to permit of engines of a more powerful type (304 class) being run in the northern district. Engineer is then pressed to complete the alterations to the platform already asked for by Mr. Stanger, to allow the 304 class of engine to pass."

316. Was that before the Baldwin engines came? Yes; the first engine of the Baldwin Company was put in steam on the 28th July, 1891.

317. The work was commenced in June. Mr. Simpson said the platform work commenced on the suburban line in June.

318. *President.*] Was the order first given in anticipation of the Baldwin engine coming? The order was not given in consequence of the Baldwin engine. The order was given, as I have tried to explain, because the whole of the system was out of gauge, and it is only one of the dozen other things the Railway Commissioners have been trying to put straight since they have come into office. True, they have not published to the world the disorganised state of the railways, and this is only one of the things requiring reform. I have papers here showing the state of the lines in 1879, and I will show from original papers that it was a very prominent question in 1888, before we took office. A *précis* of the whole question came before the late Commissioner, as I have already stated, and then it came before us in various ways, but we had such an enormous amount of work in hand that we could not put our engineers thoroughly at work on this question until some little time had passed; then it was brought up again, particularly when the line from Sydney to Newcastle was opened in 1889. I believe the Hawkesbury Bridge was opened in May of that year. It was then Mr. Halligan, the District Engineer in the North, wrote pointing out that the large type of engines in use in the south could not be run on the Northern Lines. It was also represented that platforms varied in distance from rail at the top from 2 feet to 2 feet $6\frac{1}{2}$ inches, and the bottom from 1 foot $9\frac{1}{2}$ inches to 2 feet 6 inches. It was pointed out that if a class of engine which had been running in the south were used where these platforms now prevented them being used, the Department could save the cost of assistant engines, and then we gave orders that this matter should be pushed on rapidly. Many of our works were then getting more forward, and we gave our engineers directions to push on more rapidly than they had been pushing on with this work. There are engines that had been worked upon the lines half an inch wider than the Baldwin engines were ordered to be. By this arrangement these platforms were altered, and the engines were enabled to run.

319. Then it comes to this, that you say distinctly that the alterations to the platforms—more especially the suburban platforms—were not made in anticipation of, nor had anything to do with arrival of the Baldwin engines? The question had nothing to do with the Baldwin engines.

320. Then I understand that if you desire to run large engines such as you had in stock on certain of the lines you would have had to alter them? Yes. We were anxious since we were getting so many of these large engines that the directions we had given long before should be carried into effect as quickly as possible, so that there should be no doubt about these large engines passing safely.

321. *Professor Warren.*] You would have ordered these alterations to be made without reference to the Baldwin engines in order to bring things to gauge? Yes.

322. *Mr. Brown.*] The fact is these alterations were set about actively at or about the time the Baldwin engines arrived here, and I understood you had an engine or engines working here as large as the Baldwin engines? I will put in dimensions showing that the measurement of the engine referred to over the cylinders was 9 feet $3\frac{1}{2}$ inches—this engine had been working here for years. [*Exhibit put in.*]

323. *Mr. Hoyle.*] Do you know at the time the alterations had to be made to the suburban platforms that these platforms would be demolished. Did you know this at the time that the quadruplication had been decided upon, these platforms would have to be destroyed? If you will tell me the date I shall tell you whether we had settled where the new stations were to be.

324. Did you know when these alterations were being made to the platforms on the suburban lines that these platforms would have to be destroyed to make room for the quadruplication of the line? Well, that all depended upon the date.

325. Mr. Simpson has sworn that June, 1891, was about the date on which these platforms were altered, was the Chief Commissioner then aware that the quadruplication of the suburban line was about to take place? I do not know anything about June, 1891, I have given you in plain words the alterations authorised by the Commissioners with regard to these works.

326. You have said that it was in consequence of the engineers being so busy, and so much work being in hand that this particular work had not been begun sooner than it was. Is it a fact that when the work was begun you put gangs of men on night and day? The Railway Commissioners do not control the way in which the work is done, directions are given to the engineer to do certain work, and we trust to their ability and skill to carry it out. Some work they are told to carry out at their convenience, other works they are told to complete at once; for an example, the opening of the quadrupled lines to Summer Hill, the engineer was told that the work must be finished for the Easter traffic, and it was done. There are other works that the engineers are told they may carry out whenever it is a convenient time with the men.

327. *Mr. Hoyle.*] I want to find out, first of all, whether it was a fact that men were put on night and day for this work. Were any orders issued by the Commissioners. I understand that before any night work can be done the leave of the Commissioners must be obtained. I will ask whether the Commissioners gave any orders to expedite this work, which would necessitate putting on men night and day?

I have already answered that sometimes we give directions to the engineer to push on more rapidly with his work. The Commissioners do not take cognisance of how the engineers carry on their work. They do not come to us and say "We want to work an hour or two overtime in order to do certain things."

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328. Is it not a fact that before overtime can be worked the permission of the Commissioners must be had? It is not a fact. There are certain cases in which the Commissioners are consulted; for example, at the end of last year the engineering department had a great need of points and cross. It was represented they could not be made in the shops sufficiently early to meet the requirements unless a night shift was put on. It was a large question, and therefore the Commissioners were consulted; but to say that an officer would have to come to the Commissioners whenever he wanted a man at Darling Harbour to work an hour's overtime loading or unloading special lots of goods would be monstrous.

329. *President.*] Supposing that the alteration in these stations was effected by having night shifts, would it be necessary for the engineers to whom the Commissioners gave direction to carry out the work to ask for permission to put on these shifts? Not if he had direction from the Commissioners to carry out the work in a certain time. In that case we would leave it to his discretion.

330. *Mr. Hoyle.*] Were instructions issued in this case?

331. *President.*] Were there any special instructions given that this work was to be done in a certain time? We gave directions that the work was to be pushed on more rapidly—to be completed as soon as possible.

332. *Mr. Hoyle.*] As this work was allowed to stand so long without the Department taking it up, will the Chief Commissioner say whether orders were given to force on this work by night and day? The Commissioners were anxious to carry out these necessary works as speedily as possible, and we have only a further period of $3\frac{1}{2}$ years before our Commissions expire, and we are anxious to complete the works we are anxious to see done.

333. *Mr. Brown.*] Are you correctly reported in saying that the whole expenditure in connection with the alterations represented £2,478, for slewing the lines, £112? The statement up to the 31st March is for altering stations and platforms £3,056 12s. 2d., slewing the lines, £112 15s. 11d., making a total of £3,169 7s. 1d.

334. That is the cost for the whole line; it represents altogether about £3,000? Yes.

Deodatus Hilin Neale, being sworn, said:—

335. I am a mechanical engineer by profession, and I am an officer in the Railway Department, entrusted with responsible work.

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336. *Professor Warren.*] What is your actual position; what is your official name? I am not aware that I have an official title.

337. *Mr. Eddy.*] He is a mechanical engineer on the staff of the Railway Commissioners.

338. *Mr. Hoyle.*] Does he advise the Commissioners as to what class of locomotive rolling stock shall be brought into the service? I, with other officers, was asked to advise the Commissioners on one occasion.

339. *President.*] Only on one occasion? Only on one, I believe.

340. *Mr. Hoyle.*] The witness has stated that his position is to advise the Commissioners on the style of locomotive plant we should have in the Colony. Is it part of your business, Mr. Neale, to advise the Commissioners as to the particular kind of locomotive stock which shall be brought into the service.

341. *Mr. Eddy.*] He said he advised the Railway Commissioners on anything that they desired to have his advice about.

342. *Mr. Hoyle.*] Is Mr. Neale's position in the service that of engineer—that of consulting or advising engineer—to the Commissioners as to what sort of rolling stock should be imported into the Department? Whatever the Commissioners ask my advice about I give them the benefit of my experience and knowledge; whatever the subject may be.

343. *Mr. Hoyle.*] Then we are to understand that his position officially was that of consulting engineer?

344. *President.*] I understand that he is a mechanical engineer on the staff of the Commissioners, and that his work is to give advice when asked for it. (To Witness): Is your position there a sort of consulting engineer. Would the Commissioners say to you, "What do you think of such and such an engine; is it advisable to have it here." Do they ask your advice periodically, or occasionally only? My reports are made in writing.

345. Are you required to advise on every question of moment as to the importation of new engines—rolling-stock; will you be consulted in such a question? Not necessarily.

346. What service do they pay you for? For the work I do, which consists of reporting on a variety of subjects as an engineer.

347. *Mr. Brown.*] Were you called upon to report on these Baldwin engines? Yes.

348. *Mr. Hoyle.*] Did you advise the Commissioners to obtain these engines? I advised the Commissioners that I thought the importation of these engines of immediate necessity.

349. What reasons had you, and what weighed with you, that caused you to advise the Commissioners to take that course?

350. *President.*] What have his reasons to do with it, if the charge here is that the engines are defective and unsuitable to the permanent way of the railway, and I cannot see how this affects the question. I want to know how it is material.

351. *Mr. Hoyle.*] Will the witness state to the Commission what his previous experience has been in this particular class of engine;—has he any experience of the class of engine regularly imported? Yes; I had this experience that I had met and conversed with some of the most eminent locomotive engineers of America, who had told me that they were greatly pleased with the performance of this class of engine, and considered them a great improvement on anything they previously had built.

352. Have you had any personal experience? I have seen the engines at work, and have spoken with the people who are responsible for them—the chief officers in the railway world; and I had the performance and consumption sheets of these engines in comparison with those previously used.

353. When this order was sent to America, do I understand that Mr. Thow was not in the Colony? He was absent.

354. Had Mr. Thow ever been consulted about the Baldwin engines being imported? That is a fact not within my knowledge.

355. Mr. Thow having been absent, I will ask the witness was he acting for that gentleman; in fact, was he not acting as head of the locomotive department in his absence? No; I was not acting as head of the locomotive department.

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356. Do you know whether any plans or drawings were sent to America ;—were any drawings and specifications sent to America with the order for these engines? Yes ; five drawings were sent of small details.
357. Were these drawings made in the Colony the complete set? Specifications for the engines were sent from America and we asked that certain alterations should be made. Drawings of the details I have mentioned were made in the Colony.
358. What were these alterations? They were the subject of some correspondence. I may mention that the Baltimore and Ohio engines were taken as the model, and I produce here some figures regarding them. As to the alterations, we desired first of all a slightly less weight on the driving-wheels, copper fire boxes, and brass tubes, and screw-reversing gear ; the other alterations were slight, and I need not particularise them.
359. Will you state why the lessening of the weight on the driving-wheels was recommended? Because it was previously laid down that $14\frac{1}{2}$ tons was a perfectly safe load on our railways, and I did not wish to exceed it.
360. You had in consideration, I suppose, the fact of the 71-lb. rail? Yes ; I had in consideration the rail used. I believe the weight of the rail was 71 lb.
361. When the reduction in the weight was made in the engine, was it made to meet the requirements of the 71 lb.—that is, that it would be safe to ride over a 71-lb. rail? I am not prepared to answer that. I am a mechanical engineer. It is for a civil engineer to state that, and that weight had been fixed at $14\frac{1}{2}$ tons per axle. I was informed that engines had been running on these lines before with considerably over that weight, and I thought that if I limited it to that weight I would be quite within the bounds of safety.
362. Did the specification set forth that there were iron or steel axles in the bogie? The specification stated iron or steel.
363. Do you know that it has been an established rule in our service only to admit steel axles in our locomotives? I do not know.
364. Does the witness know, or does he think that an iron axle in a bogie of the size of these axles would be safe? Yes ; I think it would be perfectly safe.
365. When the engines arrived did the witness know whether these axles were iron or steel? I did not examine them.
366. Was Mr. Thow here when these axles arrived? I cannot remember ; but my impression is that Mr. Thow arrived after some of the engines were running, and others yet to be put together.
367. *Mr. Eddy.*] I think I would ask the witness to think over his answer, would it not be Mr. Thow's departure and not his return that he refers to.
368. *Mr. Hoyle.*] Does the witness state that there was no responsible officer in the Locomotive Department whilst Mr. Thow was absent? Certainly not. I have not said anything of the kind.
369. Who was the responsible person during Mr. Thow's absence. Who ought to have examined these axles and locomotives? The responsible officer was the manager of the works, under whose supervision these locomotives were erected.
370. Who was he? Mr. Howe.
371. When you recommended these engines to be brought here the Railway Commissioners accepted your recommendation?
372. *Mr. Eddy.*] I would ask that some degree of order should be imposed in these proceedings ; Mr. Hoyle is suggesting to Mr. Neale things he never said ; Mr. Neale never said that he of his own authority recommended these engines, he said that he in conjunction with others had recommended them, and now he is made to appear to say that he alone recommended them.
373. *President.*] We understand that, it did not strike me in the way you said—if he and others recommended, it is not inaccurate to say that he recommended.
374. *Mr. Eddy.*] It is trying to put on one person the responsibility which does not rest upon him ; the responsibility rests upon the shoulders of the Railway Commissioners.
375. *President.*] Well, then, Mr. Neale, you in consultation with others, recommended the importation of the Baldwin engines? Yes ; I am prepared to take my full share of any responsibility of the advice I gave.
376. Who were the other persons who advised in consultation with you? They were Mr. Howe, Mr. Loughrey, and Mr. Stanger.
377. *Mr. Hoyle.*] The officers controlling the locomotive department were these gentlemen, are we to understand this, was the locomotive department controlled by Mr. Neale, Mr. Howe, Mr. Loughrey, and Mr. Stanger during Mr. Thow's absence.
378. *President.*] The witness may say whether he was consulted about these locomotives, and why he was consulted, but this Commission has not got to determine who was acting in the locomotive department during Mr. Thow's absence, how does that help us?
379. *Mr. Hoyle.*] They were responsible for the safe working of the Department during the absence of the head of it.
380. *Mr. Eddy.*] The Railway Commissioners personally administered the locomotive department during the absence of Mr. Thow. We took a greater responsibility than usual, and we distributed the detail responsibility over four officers.
381. *Mr. Hoyle.*] Did you examine the Baldwin engines after their arrival in the Colony, after their construction and during their putting together? Yes.
382. Did you find any defects in any part of the engines? In none of them.
383. Was there any defect in the wheels, or did you hear of any defect in the wheels? There were no defects in the wheels.
384. Did you hear of any defects in the wheels? I heard some criticism which was extremely misplaced, and made by people who understood nothing about the wheels, they did not understand the way wheels were made, and they were mislead by taking a little over-lapping of iron for a flaw.
385. There were no flaws you consider? The wheels were much safer than the ordinary make, and the inventor of them had received a medal for inventing these wheels. I would always recommend the use of the Baldwin wheels instead of the English wrought-iron wheels where ever I went. The English depends upon welds, but the Baldwin does not depend upon welds.
386. Is it a new or old principle on which these wheels are made? It is a new adaptation of an old process, called "The Cold Spoke" process, used by Owen and Dyson of Rotherham, the inventor of the adaptation being Mr. Vaulchain.
- 387-8. Were there ever any of these wheels made before? Yes ; thousands made by the old process of which this is an adaptation, the vital part is made on the "Cold Spoke" process.

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389. Are you aware that one of the tender axles which was attached to a passenger train broke down? I cannot say that I am fully possessed of the facts of that case, but I am under the impression that the journal was twisted off—we do not call that a broken axle.

390. Was it before this accident or after it that any minute examination was made of this axle, or minute examination or tests made of the quality of the material;—were such examinations made before the engines began to run, or after? Tests were not made before the engines commenced to run. Not in this Colony.

391. Did you subject these axles to any minute examination before they commenced to run? Personally I did not do so.

392. Do you know if any of the other officers—who with yourself controlled the Department at the time—subjected these axles to any minute examination or test? I cannot answer that, it is not within my knowledge.

393. Do you say that you are not aware that one of these axles was broken?

394. *Mr. Brown.*] He does not call it a broken axle.

395. *Mr. Hoyle.*] Is the journal a part of the axle? Yes.

396. Did it come under your knowledge that any other twisted journals occurred, or axles were broken that you are aware of? Yes; but there is a distinction between journals twisted off on the inside and the outside. If inside, it is broken—if outside, it does not necessarily follow that it is a broken axle.

397. Is it dangerous for an axle or journal to be damaged as the one referred to in the evidence yesterday was damaged? I do not know what was the evidence yesterday.

398. If the engine or the train on which this axle is broken had been travelling at the rate of 30 miles an hour would it have been dangerous then for the journal to be twisted off? That is an instance which in a large number of cases might have a different result. Only about one per cent. of the axles that are broken cause any injury to life or limb or serious injury to the rolling-stock or permanent way.

399. Is it your opinion that if this particular train had been going at 30 miles an hour that when this journal twisted off no danger would have resulted to the life of anyone in the train? Well it is a question of what the danger would have been, it might be 1 in 1,000.

400. *Mr. Brown.*] Would you have liked to have been in the train? Well, I would not have liked to have been in it.

401. *Professor Warren.*] Suppose the train were going at the rate of 30 miles and the front bogie axle broke on the inside, would that be dangerous? The thing can only be arrived at from records. A great many axles break every year—and not many result in accident.

402. Would it have the effect of making the front drop down? Yes. It might fall and the others take the weight, or it might not.

403. Do you say that in the majority of cases when a front bogie axle breaks that nothing happens? Yes, that is my experience.

404. *Mr. Hoyle.*] Have you had any experience in your life as a mechanical engineer of accidents of this kind, do you know whether axles have broken in some places? I was chief draughtsman for four years on the Great Eastern Railway, where the rolling stock and traffic was 50 per cent. larger than here, and all the broken axles passed through my hands. I examined the fracture and had drawings of each axle made for the Board of Trade, and during the whole of that time not a single passenger was injured through a broken axle. I should say there were about 30 broken axles a year.

405. *Mr. Hoyle.*] Were they bogie axles? Some were leading engine axles, the breakage of which is more serious because then there is only one axle to uphold the front of the engine, whereas in a bogie engine there are two. I remember on one class of engine three leading axles broke. After I left the line several extra large axles broke and no serious injuries resulted.

406. What was the rate of speed the train was going at? They were large express engines with 7 ft. 6 in. driving-wheels which could travel at 55 miles an hour.

407. Do you know when this axle broke whether the wheel came off? I do not know.

408. From the opportunity you had of knowing do you believe the wheel would come off? That depended upon whether it is an inside or an outside journal.

409. In this particular case was it an inside or an outside journal? It was an inside one.

410. Do you know in this case whether the wheel did come off or not? I believe that when it broke the engine was almost at a state of rest.

411. I am referring to the case of the engine at the Sydney Station. It was coming in at a very slow rate of speed, and what I want to know is whether the wheel in that case came off? Well I did not see it, and I should prefer the question being asked from some one who did.

412. If the axle broke, and the wheel came off, what, in your opinion, would be the result if the train was travelling at 30 miles an hour? I think I have stated my general experience.

413. *President.*] I understand that there might be an accident or not, but in any case the percentage of accidents was very slight in these cases.

414. *Mr. Hoyle.*] After the axle broke did you make any tests of the iron, or do you know if any tests of the axles were made? Tests were made, but not by me.

415. Do you know if the iron turned out to be good or bad? It did not turn out to be what I should call good iron.

416. Is it any part of the duty of the engineer of the department to examine minutely the vital parts of an engine;—is it his duty to examine these things? If he did he would have nothing else to do.

417. If engines are brought from abroad, before any of them are run is it any part of the duty of the gentleman at the head of the department to say whether all the specifications have been carried out or not, and if everything is perfectly safe? Do you mean is it the personal duty?

418. *President.*] What I understand is this, are these engines required to be examined by some capable officer to see whether they are in a fit state to run on the lines, whether their axles are good, and so on? Certainly it is the custom to examine engines, and not only before they run, but every day after they have done running.

419. *Mr. Hoyle.*] Was such an examination made of these engines? I said I could not state positively from my own personal knowledge.

420. *Mr. Brown.*] He says he has made no personal examination, and does not know who did.

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421. *Mr. Hoyle.*] Are you aware that after these defects had been discovered orders were given by the Railway Commissioners to make these engines safe, that new steel-axles should be put in the place of the iron ones? I am aware of the substitution.
422. Have steel axles been put in all the engines? I believe they have, but I cannot speak absolutely; I have every reason to believe so, but I am not the officer who changed them.
423. Do you know whether it is the intention of the locomotive department to put new steel axles where it has not already been done?
424. *Mr. Brown.*] How can he tell you that?
425. *Mr. Hoyle.*] Do you know that new axles either have been put in, or have to be put in, that in fact they are ordered?
426. *Mr. Brown.*] I suppose he can tell you that, as a matter of fact, some have been put in, and he presumes others will be put in.
427. *Mr. Neale.*] Mr. Howe would know. It is under his directions these axles have been changed. I would prefer that you ask that gentleman.
428. *Mr. Hoyle.*] Are you aware that the trailing wheels have been bored out, and larger steel axles put in than the original iron ones? In the trailing-wheels certainly not.
429. But in any of the bogie-axles, have they been replaced by larger axles of steel? Yes.
430. Were the bogie-wheels bored out to admit of a larger journal? Yes.
431. Has a face been turned on the wheels since then, and iron rings put on the boss to strengthen them? Yes; two iron rings have been put on.
432. Have you ever known a similar thing to be done? Yes; the Great Eastern Railway. About 1861 steel was a new material, and a great deal was expected from it. In some of Robt. Sinclair's engines with 7-foot driving wheels 16 by 24 cylinders, the original $5\frac{1}{2}$ inch axles were found too small, and larger axles $6\frac{3}{4}$ inches diameter were substituted and put in the same wheels.
433. I understand the driving and trailing and coupling wheel axles of the engines were originally steel? No; I believe they are iron.
434. I am asking you about the bogie;—do you know where, in any case, an iron axle has been taken out, and the hole in the wheel made larger, and steel axle then put in its place? Yes; hundreds and thousands of cases.
435. Do you know whether wrought-iron rings have ever been shrunk on to the bosses of the wheels to strengthen them? In thousands of cases. There is no danger of the ring coming off if they have been shrunk on properly. Is not every tire on the railway shrunk on? and if it is safe to shrink on a tire which has a side blow against the rails, is it not safe to shrink on a ring?
436. Is there any liability of the rings put on to the bosses of the wheels to strengthen them coming off? I do not think that, humanly speaking, there is any possibility—there is certainly no possibility of one of the rings coming off because it is between the wheel and the box, and I think it a very remote chance of the outer one coming off.
437. Is the ring put on the boss fastened the same way as the tire? A great number of tires are not fastened except by being shrunk on.
438. The tires you refer to, are not they also fastened with a set screw? Yes; they are fastened with some fastenings.
439. Is the ring put on the boss of the wheel also fastened with a set screw to make it secure? No; I believe not.
440. Now, if these rings came off is it the opinion of the witness that the bosses of the wheels would be unsafe? No.
441. Then, why were the rings put on if it is not unsafe to take them off? I will explain. You want a wheel that is durable as well as safe. A wrought-iron driving-wheel, for example, is composed of a number of pieces welded together. In time, with the vibration of constant working of the engine, some of these welds will give way, but it does not follow that an accident will consequently happen, because the giving way of the wrought-iron welds in these cases is gradual; but you have this inconvenience, that when you find it is giving way you have to take the wheel off and replace it with another. It will go on gradually becoming worse and worse. In consequence, these rings are put on to prevent the occurrence of any crack. Removing the wheel, if the crack once starts, is only a question of time, and in order to prevent that the ring is put on. If one of these rings dropped off the engine-driver would notice it, and the wheel would be marked for taking off.
442. Do you consider that it is the custom to shrink on rings instead of having your bosses sufficiently large? I do not say it is the custom, but it has been done, and so far as I know with perfect immunity from accident.
443. Were the bosses in these wheels larger or smaller than those of the wheels you have seen done in England? I cannot say that without reference to the wheels themselves.
444. Do you consider that the bosses of the wheels with the old small iron axle were anything too large? I consider that they were amply large.
445. But if the ring came off and the boss of the wheel burst before the driver noticed it, would there not be a serious result? These things do not happen suddenly; it is not so much a question of safety as durability.
446. If you consider iron safe, but steel more safe, why was it considered necessary to put in steel axles instead of the original iron ones? On this point there are a great many opinions; as doctors differ, so do engineers. Some engineers consider steel axles best; others, that an iron axle made of scrap is best; others still, that an axle made of muck-bars are the best. Muck-bars are bars welded together as they leave the rolls. I may hold one opinion, and someone else another, and the practice of English railways differs in this respect.
447. You have already stated that the iron axles which came with these engines were sufficiently strong, and he has given no reason why additionally strong steel axles should be put in their place. Was it to increase the weight on the bogie? Not exactly; it would not increase the weight as much as a man riding on front of the engine. I did not advise it; I was only an on-looker, but I believe it was done because it was thought the journals would run cooler. They would give more bearing service, and run cooler.
448. Was there sufficient lubrication of the journals and the boxes? In a letter written to the Baldwin Company, we asked for extra lubrication on account of the heat of the climate, dust and so on, our line

line being very dusty. And I believe they tried to comply with our requirements and provide for sufficient lubrication. That letter was written on the advice of myself, Mr. Stanger, Mr. Loughery, and Mr. Howe.

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449. Do you say that there was the necessary provision made for lubrication in these engines when they arrived? Yes.

450. Now since you say you have seen that the proper request for lubrication was made, can you say why these particular journals ran hot? It is very difficult to say why these journals ran hot—as in other things you may take great pains and still things will not happen as you expect.

451. Do you, as an engineer, think that if a journal such as the one that broke ran hot, it was the result of a defect in the design of the bogie or the axle or the part of the axle which ran hot and twisted off? It all depends upon the circumstances, the best axle in the world will twist off if something goes wrong in the supply of oil.

452. The witness has already stated that he saw that the proper provision was made for lubricating the axle. Now we find that by reason of extra heating one of the axles came off. Having satisfied himself previously that there was sufficient provision for lubrication, I now ask him whether there was or was not a defect in the design, and that the journal twisted off in consequence of the overheating? Well, I cannot understand so long and complicated a question, which involves statements that I cannot admit.

453. *President.*] Did the journal twist off because of overheating? Yes.

454. *Professor Warren.*] Did you consider the bearing-service provided by the Baldwin Company sufficient for these axles? Yes.

455. And the pressure on the bearing-surface is not excessive? No, it is not.

456. Then how do you account for the axles running hot if the lubrication is sufficient? Sometimes it is a very difficult thing to account for a journal running hot. I remember one particular part of an engine seized twice when driven by the same driver. He was a good man and an experienced driver, and we could not find the reason of it. A little bit of grit or waste may run in between the bearings and the journal, and make them get hot.

457. Did you draft the specification for the engine? No; it was forwarded to us by the Baldwin Company, and I, in conjunction with three other officers, suggested certain alterations. We advised the Railway Commissioners that it was a good engine, but that in order to answer the requirements of our railways, certain modifications would be necessary.

458. What alterations were suggested? There was a draw-hook. A suggestion as to the form of the cylinder-flanges was made, also the contour of the tyre, so that we should get the proper shape. Then there was a suggestion as to how they should make the big end. We prefer the bolt and block big end to the strap big end, which is used in America.

459. I understand that the specification that was sent by you to the Company was a modification of the specification sent by the Baldwin Company to the Commissioners? Yes.

460. Was anything said in that specification about the quality of material? A great deal was said about the quality of the boiler and fire-box material, and the tubes, and the tests to which they would be subjected was also stated.

461. Was that not the case with regard to all the material? No; I do not think that anything was said about the tests for the axles. It appears that it is not usual to specify tests for locomotive axles.

462. Do you mean to say that it is not usual to specify tests for locomotive axles for engines ordered in England? Well, it is done sometimes, and often is not done. I have never done it in any specification that I have drawn up myself.

463. But do you not require the very best material in an axle—the finest material that can be produced? Yes; you require very good material, but for that you rely upon the reputation of the firm from whom you order the engine.

464. That is to say, you do not specify any tests? No; it has during the last few years been more customary to do it, but it is not always done, and was very seldom done ten years ago.

465. Do you know that all makers of axle specify that their steel shall stand certain elongation and reductions of area? Yes; but when it comes to first-rate locomotive axles it is customary to rely more upon the purity of the material used and not to specify the tests of strength. Where that is done it is usually in the case of cheaper axles. The makers then say "We are giving you a cheap axle, and in order to satisfy you that it is equal to your requirements we say that they will stand such and such a test," but where you go to a first-class firm such as Vickers & Company they simply say "We supply the best axle," and it is not usual in that case to specify a test.

466. Do you mean to say that Vickers & Company do not say that their axles shall stand certain tests? Well, they have during the last few years, but I do not think that you will find that practice has existed long.

467. Did you say that it had existed for ten years? No, not so long; and I think you will find that it is done now because they are making a large number of axles by a cheaper method. I never heard of any specifications for tensile strength and elongation in the case of scrap axles.

468. Not for Yorkshire scrap axles? No.

469. You trust to the honor of the firms supplying the axles in fact? Yes; the scrap is carefully selected, and carefully worked, and the reputation of the firm is supposed to be a sufficient guarantee of its quality.

470. And in writing a specification then you would not think it necessary to supply any tests? No; but I should take this precaution, that I should only ask for tenders from certain first-rate firms.

471. *President.*] The Baldwin firm is a first-rate firm, is it not?

472. *Mr. Eddy.*] I would ask whether it is necessary to ask Mr. Neale as to what he would do under certain circumstances in which he was never called upon to act?

473. *President.*] The Baldwin engine firm that you ordered these engines from is a first-rate firm, is it not? Yes; a very good firm—a firm of very high reputation indeed.

474. *Mr. Hoyle.*] I wish to ask the witness whether, when he recommended certain specifications, he made any recommendation as to the quality of material that should go into the axle of the bogie and tender wheel? No.

475. I understand from the answer you gave Professor Warren that you trust to the honor of the firm to supply first-class materials? Yes; that is the custom.

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476. Are you aware a discussion arose in the Department as far back as 1886 on this question of axles? Of iron axles?
477. Regarding the quality of steel that should be put into the axles of our rolling stock? Yes; but I was not talking about that.
478. What I want to point out is this, that our Railway Department has always jealously guarded the interests of the travelling public, and in that respect I believe that the present Commissioners are no exception to the rule, and in doing that, when in 1886 they required some locomotives, the then Locomotive Engineer, Mr. Scott, insisted that the axles should be of a certain quality.
479. *President.*] Do you know what Mr. Hoyle is asking? I do not. I had not then arrived in the country.
480. *President* (to Mr. Hoyle). How can you get that from this gentleman;—you can probably get it from somebody else;—if it took place before he came to the country, how can he know anything about it?
481. *Mr. Eddy.*] I suggest that it has no bearing upon this question. A contract was entered into by the Department some years ago for a supply of axles and tyres of a certain kind of steel for a number of years. The fact that that is demonstrated to you does not tell you that the Railway Commissioners concur in it, or otherwise, and it is therefore quite apart from this question.
482. *President.*] Yes; I do not see that it has anything to do with it.
483. *Mr. Hoyle.*] The witness has already admitted that the journal surface was sufficient, and he has no reason to believe that any of the surfaces were not up to the requirements;—is it a fact that there were only small oil-cups fitted to the bearings for the purpose of lubricating them when the engines came here? Which bearings do you refer to?
484. The bearings of the bogie wheels? They are lubricated from beneath, not by oil-cups.
485. Well, were they supplied with oil-cups when they came here? I should not exactly call them oil-cups. They were supplied in the way in which it is customary to supply American locomotives.
486. Then do you think that sufficient provision was made for lubrication? Yes.
487. You said just now in your evidence that in revising, or rather in altering the specifications submitted to you from America, you provided for certain modifications in the draw-hooks;—were the draw-hooks that you provided for in your specification on the engine when they came here? Some clerical error had been made in the drawing rooms of the Baldwin Company, and the engines were not in that respect to our requirements. The Baldwin Company recognised that, and agreed that the alterations should be made at their expense.
488. You say that stronger hooks were made for these engines after they arrived? Yes.
489. Do you know whether any of the draw-gear on the engines has broken since they commenced to run here? I believe that one or two of the hooks originally sent out broke.
490. Were any of the draw-hooks that were originally supplied with any of these engines used on the lines of this Colony? Yes, I believe they were used for a short time.
491. You said here just now that the specification provided that the engines were to have a different hook—a stronger hook;—I ask now whether you made any report to the Commissioners to the effect that these hooks were not in accordance with the specifications.
492. *Mr. Eddy.*] This witness has said several times that he had nothing whatever to do with these matters, and that somebody else ought to be asked these questions.
493. *President.*] Yes, I know that is so. There is no desire on the part of the Commission to limit the inquiry at all so far as we are permitted by our Commission to inquire into the question, but supposing they did use these draw-hooks, if no accident had happened I do not see what bearing the evidence has upon the case.
494. *Mr. Hoyle.*] Yes, but you will remember that one of my charges was that gross negligence has been shown, and that the Commissioners admitted that charge.
495. *President.*] No, I do not know that.
496. *Mr. Brown.*] Which set of Commissioners do you mean? Neither set has admitted that so far.
497. *President.*] The first charge that you made was “That in consequence of the extra width of Baldwin passenger engines or their great length the platforms on various parts of our lines have had to be altered.” The second charge to the effect that the Baldwin passenger engines were not required and should not have been imported, and that the money spent upon them was, therefore, an unnecessary expenditure of public funds, was disallowed. The third charge, which now stands as the second charge, is as follows:—“That the safety of the draw-gear will be in danger if the Baldwin passenger engine or the Baldwin consolidation goods engines draw the loads that it is stated by the railway authorities they are intended to draw.”
498. *Mr. Brown.*] Is not that the one to which you referred when speaking just now of the draw-gear?
499. *Mr. Hoyle.*] Yes, but in the fifth charge it is said that the Baldwin passenger engines and the Baldwin consolidation goods engines are faulty in design, and that certain parts of the axles of the bogies and tenders are dangerous, and gross neglect was shown by allowing the engines to run before the parts in question were removed. That might not refer to the particular question before you; but what I wanted to prove is that neglect has been shown.
500. *President.*] Yes, but we are not now trying an action in which there has been an accident to a passenger, and the question is whether the Commissioners should allow a particular engine to run with particular draw-gear. That might show some neglect on the part of the Commissioners, but that is not the question. We are simply inquiring into the question as to whether the Baldwin engines are defective or not.
501. *Mr. Eddy.*] Certain defects were found in the engines, and active steps were taken to put them to rights.
502. *President* (to Mr. Hoyle.)] You cannot go into the question of whether there has been any neglect on the part of the Railway Commissioners or anybody else. All that we can allow you to call evidence upon—and I am not binding myself to allow that yet—is whether these engines, when imported, were defective and not up to the standard and specifications required by the Commissioners, and that it is quite a different thing from the question as to whether there was any neglect on the part of the Commissioners.
503. *Mr. Hoyle.*] One of my charges set forth that if these engines haul the load that the railway authorities say that they are intended to haul, the safety of the draw-gear is endangered. What I want to find out is this:—We heard yesterday that this draw-gear had been removed to give place to a stronger gear. Now the witness in reply to a question of mine says that all the draw-gear was not removed—that

admittedly

admittedly defective draw-gear was allowed to be used, and that he believes that two of these defective hooks broke.

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504. *President.*] Supposing that is so, the evidence is that that has been remedied, and it has, therefore, nothing to do with this particular point.

505. *Mr. Hoyle.*] But what I want to show is that those engines were so powerful that they broke the draw-gear. Does Mr. Neale know whether this draw-gear was attached to a passenger or a goods train?

506. *Mr. Neale.*] I do not.

507. *Mr. Hoyle.*] Will the witness state that if this hook had broken—

508. *Mr. Eddy.*] All these things are matters of inference. Can Mr. Hoyle state that any single draw-gear in the twelve Baldwin engines that he is talking about ever broke when used in drawing trains.

509. *President.*] Yes. I must say that with every desire to allow Mr. Hoyle to inquire into every point that we are allowed by our Commission to inquire into, we cannot take into consideration the question of whether the Railway Commissioners were negligent in allowing this, that, or the other. If the Baldwin engines were defective it was not their fault as far as we can find out at present.

510. *Mr. Hoyle.*] I do not want to show that it was the result of neglect. I want to show that these engines do break the draw-gear, and I want to ask the witness as an engineer what would be the consequence if one of these draw-hooks broke on a goods train?

511. But did any of the draw-hooks break?

512. *Mr. Hoyle.*] In the charge to which I have referred I state that if the loads that these engines are intended to haul are put on they do endanger the draw-gear.

513. *President.*] Do you mean that they endanger the present draw-gear?

514. *Mr. Hoyle.*] I refer to any draw-gear used in the service. We have had it admitted that two hooks have broken.

515. *Mr. Brown.*] What you want to say is that this draw-gear is unfitted for the work of the railways?

516. *Mr. Hoyle.*] No; I believe that the Commissioners have increased the strength of their draw-gear.

517. *Mr. Brown.*] Then does that satisfy you?

518. *Mr. Hoyle.*] Yes; but my charge is this—that if the Baldwin engines haul the load that it is stated by the officers of the Department that they are intended to carry, that is to say, that if one of these engines is to do the work of two ordinary engines, the draw-gear is thereby endangered.

519. *Professor Warren.*] Which draw-gear?

520. *Mr. Hoyle.*] The draw-gear between the engine and any part of the frame.

521. *Mr. Eddy.*] That is all supposition. The Commission has been appointed to try a direct charge that these engines are unsuitable to our railways. As far as hypothetical cases are concerned, it might be said if a train ran off the rails on the Blue Mountains a large number of people might be killed; that would be just as much to the purpose. As a matter of fact, these charges were made in Parliament before a single Baldwin engine ran upon the railways of New South Wales, and all the facts in support of them placed before you now have been recently discovered, a great many of them during the last week or two; a great many of them, too, are hypothetical.

522. *Mr. Hoyle.*] I think those charges were admitted yesterday.

523. *Professor Warren* (to Mr. Neale).] Is the draw-gear equal in strength to the maximum pull that will come upon it when the engine is taking its full load? The draw-gear on the engine?

524. Yes? Yes; I consider that it was quite equal to what it ought to be.

525. Have you gone into it carefully;—have you made any calculations upon the subject?

526. *Mr. Eddy.*] Mr. Thow will be prepared to give you evidence upon this point.

527. *President* (to Mr. Neale).] You have not gone into this? No; I have not gone into it very much.

528. *To Mr. Hoyle.*] You say that these engines were imported to draw very heavy loads, and you say, that having brought out these engines capable of drawing such loads, the Railway Commissioners have thereby been endangering the draw-gear?

529. *Mr. Hoyle.*] That is my contention.

530. *Mr. Eddy.*] Then I should like you to ask him to prove it.

531. *Mr. Brown.*] He is going to call one of your witnesses to do that.

532. *Mr. Hoyle* (to witness).] Were two engines known as compound engines imported with the other engines? Yes.

533. Have these compound engines been at work? Yes.

534. Do they travel at anything like a decent speed? Yes.

535. Did you visit Penrith at any time relative to these engines? Yes.

536. Would you tell the Commission why you went to Penrith? To ride on the compound.

537. Was any complaint then made to you about these engines being slow? No.

538. I might ask a personal question here. Of course, Mr. Neale is one of the gentlemen who recommended the Commissioners to import these engines. In a letter written by you to the Commissioners on the 27th March, 1890, you recommended to the Commissioners the offer of a certain English firm to supply locomotives to the Colony, and in that recommendation you said further what should be the standard train. You say: "I give the following figures for the desirable standard trains on gradients of 1-40:—

PASSENGER TRAINS.				GOODS TRAINS.			
2 Sleepers	...	...	50 tons	25 Wagons at 8 tons (loaded)	...	...	200 tons
1 Car 1st (lavatory)	...	...	23 "	1 B. Van (bogie)	...	...	16 "
1 Car Compo. (lavatory)	...	...	23 "	Engine and Tender	...	...	80 "
1 2nd	...	...	23 "				
1 B.V. (lavatory)	...	...	21 "	Total	...	...	296 "
6 Vehicles (loaded) weighing	...	...	140 "				
Engine and Tender	...	...	80 "				
Total	...	...	220 "				

The difference in weight, 76 tons, would be offset by the higher speed required with the passenger train." Can you tell us what the weight of the Baldwin passenger and locomotive consolidation engine is? I am not prepared to admit that Mr. Hoyle has quoted my figures correctly. I should like that letter placed before the President.

539. *Mr. Hoyle.*] I place before you, Mr. President, a Return laid by the Minister for Railways upon the Table of the House and printed by the authority of Parliament.

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540. *Mr. Eddy.*] And I would wish to call your attention to the fact that whatever these figures are they have no bearing upon this inquiry. It is not the weight of the average train that is given in them.
541. *Mr. Hoyle.*] I contend that it has a bearing on the point. Mr. Neale recommended here an engine at 80 tons. I want to know why, having done that, he has since recommended a heavier engine to be brought to the country. Here he recommends that the engine and tender should be 80 tons, and I want to know why he has since recommended that a heavier tender should be imported?
542. *Mr. Eddy.*] I would point out that this has no bearing upon the question at all. You might as well say that every officer who reports to the Commissioners is by his report to tie the Commissioners in their actions. When an officer is called upon for a report he reports to the best of his ability, and the Commissioners decide the matter in a way they think best, giving due attention to all the facts of the case. Mr. Neale never intended to tie the Commissioners to this weight of train, but simply wished to state what weight an engine of that particular kind should carry.
543. *Mr. Hoyle.*] I want to point out that in this instance Mr. Neale recommended this weight of train to the Commissioners, and that subsequently engines intended to draw a much heavier train were brought to the country.
544. *Mr. Brown.*] Can that report of Mr. Neale's bind the Commissioners in any way?
545. *President.*] I do not see exactly what particular bearing the point you are trying to establish has upon the question. Of course it is to be presumed that every question is put to the witness by me, but as a matter of convenience to you and to myself, I have asked you to put the questions directly, instead of filtering them through me, but now you are cross-examining this witness, and you want to contrast something that he has said before with what he is saying now. Do you want to discredit him, because that is what it looks like, and you call him as your own witness.
546. *Mr. Hoyle.*] He has reported that an engine should be at a certain weight, and now we have an engine of an extra weight brought to the country.
547. *President.*] I want to point out that this gentleman has been called by the Commission, but called at your request, and now you want to cross-examine him. I do not see what effect what you have put in would have upon the question. The paper says: "We do, however, undoubtedly badly want more powerful engines for the heavy parts of the line, and as showing that one class of engine would do for both goods and passenger traffic, I give the following figures for the desirable standard trains on gradients of 1 in 40." And then it is that the engine and tender of 80 tons come in.
548. *Mr. Hoyle.*] Well, I take it that when Mr. Neale made that report he had in view the strain which would be placed upon the draw-gear.
549. *Mr. Eddy.*] No such construction was ever put upon his figures.
550. *Professor Warren.*] It appears to me that all you prove is that the Baldwin engines weigh more than 80 tons.
551. *Mr. Hoyle.*] Quite so, and the fact that the Baldwin engines will endanger the safety of the train.
552. *President.*] You maintain that Mr. Neale supplied the figures furnished in the Parliamentary return as the desirable weight of a train?
553. *Mr. Hoyle.*] Quite so.
554. *President.*] Do you want to make out then that your own witness is wrong in what he has stated to-day?
555. *Mr. Hoyle.*] What I want to make out is this, that whilst Mr. Neale, as an expert, recommended a train of a certain weight to be a safe train, engines have been imported for the purpose of drawing a heavier train, and that if the train goes beyond the weight recommended by Mr. Neale it is not safe for the draw-gear.
556. *Mr. Neale.*] Might I make an explanation?
557. *President.*] Certainly; in one moment. I will allow the question to be asked (to Mr. Hoyle): You want to ask the witness whether he made this report to the Chief Commissioner? (Witness): Yes, I did.
558. *President (to witness.)*] Now you want to explain something? I should like to say that the addition of 100 tons to the weight of the engine, would make no difference to the draw-gear in the train, because the weight of the train strains the draw-gear by its weight, and the weight of the engine has nothing to do with the strain on the draw-gear of the train at all, and therefore the substitution of a 90-ton for an 80-ton engine would make no difference to the draw-gear of the train, and I should further like to say that in these figures I contemplated a Mogul engine, in which the leading end of the engine is supported by one axle and two wheels; but we have had engines of the ten-wheeler type, in which the leading end is supported by two axles and four wheels, which gives greater security, but at the same time some increase in weight.
559. *President.*] This report will be admitted. [*Exhibit.*]
560. *Professor Warren.*] You mean, Mr. Neale, of course, that if one engine could pull 50 trucks, and another engine could pull 100 trucks, that pulling 100 will entail a greater strain upon the draw gear than the one pulling the 50 trucks? Yes; but the addition to the weight of the engine would not strain the draw-gear any more.
561. *Mr. Hoyle.*] Will the additional weight of the engine have any effect upon the permanent-way when going at a high rate of speed?
562. *Professor Warren.*] You had better not ask Mr. Neale that question. You will be able to get it from subsequent witnesses.
563. *Mr. Hoyle.*] I would like to ask the witness whether, in increasing the haulage power of the engine, we should or should not increase the strength of the draw-gear? Not necessarily.
564. That is provided that the draw-gear was strong enough previously. Can you tell the Commission what was the load hauled by our strongest engines—say the strongest engine we had before these Baldwins came here—what was the load hauled by such an engine on a goods train? What was the number of trucks? On what gradient?
565. On the mountain grade—say, on the Lapstone grade—a grade of about 1 in 40? Which do you mean?
566. Take the Mogul engine that is now, I understand, running the Northern express—what would be the load of trucks that that engine could haul up the grade at the Lapstone Zig-Zag? That engine is not used to haul trucks.
567. Is the Mogul the strongest engine employed on the railway before the arrival of the Baldwin engines? What do you mean by the strongest engine?
568. The one that can haul the greatest load? No.
569. What could the strongest engine on the lines, before the arrival of the Baldwin engine, haul? Fourteen waggons.

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570. Will you swear that that was the maximum load? Yes.
571. Will these Baldwin engines haul double that load? No.
572. What is the maximum load that the Baldwin engines can haul unassisted? I find the greatest difficulty in answering these questions, from the vague manner in which they are put.
573. *President.*] That is out of your line too, is it not? No, it is exactly in my line. But a question of this kind all depends upon the gradients and the curves.
574. *Mr. Eddy.*] Might I suggest that, instead of having this officer to answer questions of this kind, it would be more valuable to you to have the Locomotive Superintendent, or the Traffic Superintendent, who come in daily contact with these engines, to answer them.
575. *President.*] If you can tell Mr. Hoyle that there is an officer who can give him the information he desires, he might be satisfied; but perhaps he will not be satisfied, and in that case I can only allow him to proceed.
576. *Mr. Hoyle.*] I am dealing with a gentleman in a high position.
577. *Mr. Eddy.*] It is no use asking that a clergyman should tell you how to drive a locomotive. There are several officers in the Department, and some can give you more valuable evidence upon certain points than others. All our officers are at your disposal.
578. *President.*] I see all that, but I do not like to decline to put a question to this gentleman if he can answer it, because it might be that Mr. Hoyle will call some gentleman who will disagree with him if he does answer it; but as I understand it, he complains that the question is put in too bald a manner.
579. *Mr. Eddy.*] And in addition to that it is not a question of pulling. The practical way is to put an engine behind and an engine in front when necessary to do away with the danger of the hauling-gear breaking. It is the actual daily work of the engines that should be taken into account.
580. *Mr. Brown.*] What you want to get at is the practical work done by these Baldwin engines. You should compare them with the best class of engines here. Why don't you ask witness the question generally?
581. *Mr. Hoyle* (to witness).] Were you ever locomotive engineer in any locomotive works in the world? I was acting and assistant locomotive engineer on the western section of the Cape Government railways. I was first assistant superintendent and then acting superintendent.
582. *President.*] But Mr. Hoyle, supposing you were conducting this case in a Court, and you were calling this witness as a party to your case, and I do not think I can give you a position involving more latitude than that of a party conducting a case in a court of law, do you suppose that after putting a witness in the box you would be allowed to ask him questions with the apparent object of discrediting all that he had previously said?
583. *Mr. Hoyle.*] I should be sorry to hurt the feelings of any gentleman present, or indeed of any man, but Mr. Eddy has tried to show that the witness should not be called upon to answer these questions, and I want to show that he has been placed in positions in various parts of the world that fit him to answer these questions.
584. *President.*] Oh, I beg your pardon, I did not understand your question. I apologise. It was entirely my fault; but from your manner I misunderstood your object.
585. *Mr. Eddy.*] I beg to differ from Mr. Hoyle's statements.
586. *President.*] I must accept Mr. Hoyle's explanation.
587. *Mr. Eddy.*] But he has made a statement in regard to my wishing to discredit Mr. Neale, whereas we have the greatest possible regard for Mr. Neale's ability.
588. *President.*] Do not suppose that that was intended. From what I have seen of Mr. Neale I am sure that he is far too intelligent a witness to imagine anything of the kind.
589. *Mr. Hoyle.*] I must ask Mr. Neale whether he thinks it would be safe to haul a train of double the ordinary size by one of these Baldwin engines. If the strongest engine on the line previous to the arrival of the Baldwin engines could haul fourteen trucks up 1 in 33, do you think that it would be safe for the draw-gear for the Baldwin engine to pull a load of twenty-eight trucks up such an incline without the assistance of an engine behind.
590. *Mr. Eddy.*] I must object to all this. I have pointed out before that it is necessary for those engaged in the practical working of the traffic to give evidence on these points, but as a matter of fact goods traffic up 1 in 33 is always assisted by an engine in the rear whether double the amount of ordinary weight is put on a train or not.
591. *Mr. Hoyle.*] A statement appeared in the *Sydney Morning Herald* to the effect that these engines would do double the amount of work of any other engine now in the service. My contention is that if that statement is true, then by putting double the amount of strain on these engines the draw-gear would be endangered.
592. *Mr. Brown.*] Supposing, on the other hand, that these engines draw one truck more than any other engine in the service, how does that affect your case?
593. *Mr. Hoyle.*] I think it helps my case. If statements have been made time after time in the public Press that double the load is going to be put on trains that are being hauled by these engines, it is important to know whether they are true, because if they are true, I maintain that the draw-gear is endangered.
594. *Mr. Brown.*] Our business is to inquire whether these engines are suitable for the New South Wales railways, and if we find that they will do better work than any other engines, that will satisfy me.
595. *Mr. Hoyle.*] I base my statements upon the authority of paragraphs in the newspapers, to the effect that they would do double the amount of work done by other engines, and I maintain that they have not done anything of the kind.
596. *Mr. Eddy.*] Mr. Hoyle says that he bases his charge upon something that he has seen in the newspapers to the effect that the engines will do twice as much, or are doing twice as much, as any other engine in the service. I would point out that the charges made by him, as a result of which this Commission was appointed, were made on the 20th August, and at that time not one single engine of the consolidation type had arrived in the colonies. I do not, therefore, quite see how the statement in the Press, to the effect that the engines were doing twice as much work as any other engines, could have appeared.
597. *President.*] Not at that time, certainly, but you must look at the date of the Commission. It is dated the 15th March, and is to inquire into the allegations made, that the recently imported Baldwin locomotives are defective and unsuitable to the permanent way of the railways of the Colony, and are not rendering

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rendering the service which was expected of them. As I understand it, under that Commission, any allegations made up to the date that the Commission was issued, becomes the subject of inquiry. I am not responsible for the drawing up of the Commission, and most heartily wish that I had never seen it.

598. *Mr. Eddy.*] The Commission says, "not rendering the services expected of them." Well, we have placed before you all the papers relative to the ordering of the engines, and we are prepared presently to bring evidence before you as to what they are now doing.

599. *Mr. Brown.*] Mr. Hoyle relies apparently upon some newspaper reports.

600. *President.*] What is the specific question?

601. *Mr. Hoyle.*] That if twenty-eight loaded trucks were attached to one of these Baldwin engines, without an engine pushing up behind, does the witness think that the draw-gear would take the train safely up 1 in 33.

602. *Mr. Eddy.*] I object to that question being put, because in actual practice such a method of haulage does not exist. An engine is invariably put behind to assist a goods train up such a grade.

603. *President.*] The Commission allow the question to be put.

604. *Witness to Mr. Hoyle.*] Would you repeat your question?

605. *Mr. Hoyle.*] You have already stated that fourteen trucks represent the ordinary load that was carried before the Baldwin engines came to the Colony, what, in your opinion, would be the effect upon the draw-gear if double that load was attached to one of the Baldwin engines up an incline of 1 in 30? Well, the answer to that question is very simple. The train could not start.

606. *Professor Warren.*] You mean that the engine could not pull twenty-eight trucks up 1 in 30? Quite so.

607. How many could it pull up 1 in 30? Twenty, with one bogie brake-van.

608. Without the assistance of an engine behind? Yes; but I should like to point out that that has very little practical bearing upon the question, because it is not the ordinary way of working.

609. *President.*] That may be, but I want every opportunity to be given for throwing light upon the matter.

610. *Mr. Hoyle* (to witness).] Have you examined any of these engines lately?

611. *Mr. Eddy.*] I would really object to this waste of time. Mr. Neale, as I have said before, is attached to our office for special purposes. He is not engaged in the outdoor practical working of the railway, and it is a sheer waste of time to ask these questions of him when they could be put to a practical man.

612. *President.*] Well, if Mr. Neale says, "I don't know anything more about it, it is not in my department," I suppose there will be an end of it, and Mr. Hoyle would not ask any more questions, but it is not for me to stop the examination as long as Mr. Hoyle thinks he can obtain evidence of value.

613. *Mr. Hoyle.*] I made the charges, and surely I should be allowed to prove them.

614. *President.*] I am deciding in your favour, and any further argument is unnecessary; besides I wish it to be understood that after I have given my decision all arguments upon the point must cease.

615. *Mr. Hoyle.*] Does the witness know that the slide-bar or the cross-head is worn on some of these engines, and that has necessitated the putting in of a brass-liner? I would, like Mr. Hoyle to specify which he means; the slide-bar is one thing, and the cross-head is another.

616. Well, I want to know whether there have been any brass-liners put in to any of the engines to make up for friction since the engines have been running? Not to my personal knowledge.

617. If such wearing did take place after the engines have been running so short a time, would you consider that a defect in the design of the engines? No, not considering the mileage they have run.

618. Can the witness say from his experience, considering that the engines came here somewhere about the middle of August last year, that it was according to the usual custom to put brass-liners on after they had been running such a short time? Yes, if there were brass rubbing-pieces in the cross-heads.

619. Does the witness know whether the axle-box has worn into the boss of the wheel on any occasion? Yes, some of them have slightly.

620. Will the witness explain to the Commission what is the cause of that? The numerous curves on the line on which they run.

621. Does witness know whether any other engines in the service have worn in the same way? I am not prepared to answer that question absolutely, I have not measured the wear on other engines.

622. *Mr. Brown.*] You told us in the early part of your examination that the specification was furnished by the Baldwin Company? Yes.

623. And that it was amended in some form or other the details of which you stated in your evidence? Yes.

624. Can you furnish the Commission with the specification the Baldwin Company supplied you with, and your amendment of that specification? The Commissioners have the specification, and I can furnish you with a copy of our report.

625. *Mr. Eddy.*] We will try to get them for you.

626. *Professor Warren.*] Is not the specification you refer to in the *Railway Gazette* of 7th November?

627. *Mr. Eddy.*] Would it not be much better to have the specification from which the engine was actually built?

628. *Mr. Brown.*] That is what I am referring to;—I am referring to a specification which was sent out by the Baldwin Company, and which was amended in your office. I want the amended specification and the original specification as well.

629. *Mr. Eddy.*] I am not sure that I can give you the original specification, but I can give you the specification from which the engines were built.

630. *Mr. Brown.*] Yes; but I think the Commission ought to have before them the specifications that were sent by the Baldwin Company to the Commissioners for Railways.

631. *Professor Warren.*] Would Mr. Eddy allow you to supply the Commission with a detailed description of all failures such as broken axles, defective draw-gear, parts of running-gear, &c., and the cost of the renewals in detail. Also, the nature and cost of all repairs which have been necessary in the Baldwin engines since their arrival, together with the mileage of each engine which has undergone such repairs, also the weight on the wheels and wheel base of both the Baldwin and the new English engines?

Mr. Eddy.] We will supply you with as much of the information as we possess, though I doubt whether we can give you the cost of the renewals in detail.

THURSDAY, 14 APRIL, 1892.

[The Commission met at 2 o'clock in the Board Room, Colonial Secretary's Office.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

ALEXANDER BROWN, Esq., J.P.

632. *Mr. Eddy.*] Before the Commission enters upon the day's proceedings I would like to say a few words in order that the Railway Commissioners' action in the inquiry now proceeding may not be misunderstood, as the Railway Commissioners are unable, in accordance with the President's ruling, to be represented by counsel at this inquiry, and so have an opportunity of dealing with the cross-examination of witnesses in the usual way, I wish to make the following statement, and I wish it to be understood that I do not question your decision, sir, in the direction in which it has been given, for we consider that on the whole, the course adopted is a wise one. Still, the proceedings are being drawn out a great deal by the admission in evidence of a lot of extraneous matter. Much outside matter is being imported into this inquiry, and in order to save time, we, the Railway Commissioners, propose not to cross-examine any of the witnesses that Mr. Hoyle may call before him, unless it be that some very unfair statement should be made. In such a case we may perhaps have to request the President to put a question to the witness, but in the ordinary course we do not intend to ask any of Mr. Hoyle's witnesses any question. But subsequently we propose to place before the Commission all the facts that may be necessary to enable them to come to a satisfactory conclusion.

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Deodatus Hilin Neale, Esq., further examined:—

633. *Mr. Hoyle.*] I would like to ask Mr. Neale whether he corrected the specifications of the Baldwin Engine Company? Yes.

634. When doing so, did you provide for the thickness of the tube plate in the smoke-box? I would like to refer to the specifications before giving an answer to that question.

635. Before proceeding any further, I would like to ask you, Mr. President, if it is customary, at an inquiry such as this, for persons to be present at the Board Room who will later on have to be examined as witnesses. Yesterday afternoon I noticed that a number of persons were present who must have heard all the evidence then given before the Commission. I wish to know, sir, is this the usual course adopted or not?

636. *President.*] This inquiry, Mr. Hoyle, is not being conducted in the same way as the proceedings in a Court of law would be carried out. If it had been, it is quite possible that the latitude which has been allowed in the way you have mentioned would not have been permitted. With regard to the witnesses in this inquiry I cannot myself see that there would be any gain effected by sending them out, because, as you will have observed, all this evidence, or a great portion of it, is published in the daily Press, and if the witnesses choose they can, to-morrow morning, read the evidence given to-day. Under these circumstances, I do not see what is to be gained by their leaving the room. In fact, I doubt if I have any absolute power to order them out. The powers under the Act referring to Commissions are very vague in their terms. In Courts of law, witnesses are ordered out of Court, because in cases involving a great conflict of evidence, it is thought advisable that they should not remain in Court, and if a Judge thinks it necessary he can even direct that the proceedings shall not be published, but here at the proceedings of this Commission, I do not know if any order we may make would be effectual, for I do not know if we have any power to make such an order, neither can I see the practical good of it, even if we had the power, whilst at the same time, I doubt our power. I think it is rather a question of taste for the witnesses themselves to determine whether they should remain or not, and it may perhaps be a matter of observation for you to make, that certain of the witnesses have heard the evidence, if you think they are witnesses of that kind, which would be influenced one iota by what they heard. It is a matter for you to call attention to by-and-bye; but I do not think I have the power, even if I thought it desirable to order them to leave the room.

637. *Mr. Eddy.*] I propose to withdraw, sir, because I am simply in a position of witness.

638. *President.*] I did not understand that your remarks, Mr. Hoyle, applied to Mr. Eddy, I thought they were directed to the engineers and others of the Department present.

639. *Mr. Hoyle.*] Certainly I did not intend them to apply to Mr. Eddy; I look upon him as being here in almost a similar position to myself. I have made certain charges, and I am here to prove my case, and I understand that Mr. Eddy, to endeavour to prove me wrong.

640. *Professor Warren.*] It seems to me very undesirable that any of the witnesses should withdraw. I cannot see that anything will be gained by it.

641. *Mr. Eddy.*] I was surprised by being put in the position of a witness yesterday; and therefore as the presence of witnesses have been objected to, I thought it would be better for me to withdraw. I am not here from any mere desire to be present. The absence of the Commissioners and officers in the Railway Department is very detrimental to its management, and the business of the country will suffer in consequence.

642. *President.*] Mr. Hoyle says that he did not intend his remarks to apply to you, but to the witnesses who are here, and some of whom it seems heard the evidence given yesterday. You have really charge of a case for the Railway Commissioners; but I do not understand Mr. Hoyle making any suggestion that you or any of the other Commissioners should withdraw.

643. *Mr. Hoyle.*] Now Mr. Neale, you stated yesterday that you amended the specifications submitted by the Baldwin Company, did you provide in your revised specifications for the thickness of the tube-plates in the smoke-box? No, because it varies very little: it is almost invariable.

644. What is the thickness of the plate in these smoke-boxes, do you know? No; I cannot absolutely say; I should imagine it would be three-quarters of an inch to seven-eighths of an inch.

645. Can you not tell me if the thickness of the smoke-box is different from that of the smoke-boxes in any of the engines running on the lines previous to the arrival of the Baldwin engines? Not positively.

646. What load do you consider the Baldwin engines ought to carry without the assistance of another engine, going up an incline of 1 in 33, taking into consideration the safety of the draw-gear? That depends

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depends upon circumstances, and on the position of the gradient. On one gradient of 1 in 33 I would have no objection to put five more waggons than on another grade of 1 in 33. Draw-gear does not break under a direct strain; within my experience I do not know that I have ever heard of draw-gear breaking whilst a train is going steadily up an incline however steep, or however heavy the train. Draw-gear breaks from jerks, more frequently in going down than in going up a hill. It is the sudden pull or jerk that breaks it. It is a question of how many jerks it would be subjected to. You may go over a piece of line with a great number of indentations; passing over these the draw-gear would be jerked, and perhaps broken. Then again you have to consider whether a breakage of draw-gear will lead to any dangerous consequences under a particular set of circumstances. It may do so, of course. For example the train may break away and rush down an incline into another train standing at a junction; or, in another case, it might break away and be brought up by another gradient without doing any mischief. So that the whole question of danger depends upon circumstances, and I must decline to lay down any general rules whatever.

647. *Professor Warren.*] You mean, Mr. Neale, that when a train comes to a place where there is a sag in the line that may be a likely place for the draw-gear to break on account of the sudden strain put upon it? Yes; there would be some strain on it.

648. Once the engine is on the grade the strain is uniform? Yes, in the way I have explained. Extra heavy brake-vans are used so that it is very improbable that any serious consequences would ensue in the event of the draw-gear breaking, even under the worst conditions.

649. *Mr. Hoyle.*] I will now put a very definite question to you, Mr. Neale. Will you state to the Commission what is the load that these engines can take up the Lapstone grade, that is the first incline between Penrith and the bottom points. What is the load of loaded trucks that these engines can pull up that grade? They can take up twenty unassisted.

650. *President.*] That is the 1 in 30 grade? Yes.

651. *Mr. Hoyle.*] I would direct the attention of the Commission to the fact that in the paper I put in in evidence yesterday it would be observed that Mr. Neale stated in making up his standard train that a standard engine, weighing 80 tons, could haul twenty-five loaded trucks. Now, in taking up this train of twenty loaded trucks you referred to just now, would you want the assistance of an engine behind; would it be necessary to have an engine to shove behind in order to assist one of the Baldwin engines pulling those twenty loaded trucks up the Lapstone? It would not be required—that is, from a purely engineering point of view, but in practical working another engine would be desirable.

652. *President.*] I take it that you mean for more abundant caution? Yes, that is what I mean.

653. *Mr. Hoyle.*] Do you say that any jerks take place on an incline? No, what I say is that they take place on changes of grade.

654. Suppose one of these engines was taking a load up one of the Lapstone grades, and steam went down and had to be got up again, and by reason of additional steam being put on would not that cause a jerk? That would depend upon how the engine was handled.

655. Do not jerks occur on these inclines? They occur on changes of grade.

656. Now Mr. Neale, I have put a specific grade to you, do not jerks take place on this specific grade? No; I am not aware that jerks do take place on this particular grade. Of course it might be possible to produce the jerk by a singular combination of circumstances, generally speaking the jerks do not take place.

657. *Professor Warren.*] You mean that if the steam ran down on ascending a grade, and was then put on suddenly it would cause a jerk? Yes; but as a matter of fact the man would stop his engine slowly, keeping his train stretched, and then start steadily again.

658. *Mr. Hoyle.*] Do you know when the order was sent to America for the Baldwin engines, whether any letter was sent with it? Certainly the order was contained in the letter.

659. Who sent the letter? It was sent by the Secretary to the Railway Commissioners.

660. *Mr. Eddy.*] I would like sir, to point out the misleading way in which these questions are put by Mr. Hoyle. Mr. Neale has stated before you that twenty waggons can be drawn up a grade of 1 in 30 by a consolidation engine. He never referred to a grade of 1 in 40, and it is to a grade of 1 in 40 that the paper referred to by Mr. Hoyle has reference.

661. *President.*] It does not mislead us in the least.

662. *Mr. Hoyle.*] I would like to know, Mr. Neale, whether when you were called upon to advise upon the importation of these locomotives, there was any meeting between you and any other officers of the Department relative to this matter? Yes; certainly there was.

663. Was it in the form of a conference? Yes.

664. Where was it held? In my office.

665. And who were present? The officers present were Mr. Howe, Mr. Stanger, Mr. Loughrey, and myself.

666. Were any of the Railway Commissioners present? No; not in my office.

667. At any conference? —

668. *President.*] Were the Railway Commissioners present at any conference between the gentlemen you have named and the Railway Commissioners, relative to the importation of these engines? Certainly they were.

669. *Mr. Hoyle.*] Can you tell us whether at that conference there was any objection raised to the importation of these engines?

670. *President.*] Would you be so good as to show the commission, Mr. Hoyle, how these facts affect the inquiry before us. Supposing at that conference there were all kinds of different opinions expressed, the fact still remains that the Baldwin engines were ordered, and what we have to inquire is, as I have frequently stated already, were they were defective and unsuitable to the permanent-way of the Colony, and not capable of doing the work they were expected to do. Supposing there were all kinds of divergences of opinions at the conference, how would that effect the matter?

671. *Mr. Hoyle.*] I think I remember that when a similar statement was made Mr. Eddy said no such conference was held.

672. *Mr. Eddy.*] No such statement was made by me.

673. *President.*] Supposing Mr. Eddy had said that there was no such conference, and suppose he had been forgetful of the fact, how does all that affect the matter we have under inquiry?

674. *Mr. Hoyle.*] Because if there was an officer who opposed the importation of the Baldwin engines I would like to have him called to state why and upon what grounds he objected to these engines being imported.

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675. *President.*] Surely if they are defective that is enough in your case, and if they are not it cannot make any difference because someone at some time thought that they probably would be defective.

676. *Mr. Neale.*] I must object, sir, to assumptions being made about things I never said at all. I have never stated that there was any difference of opinion, and yet Mr. Hoyle speaks as though I had said so.

677. *President.*] I think I have said that at all events we do not assume it.

678. *Mr. Neale.*] As a matter of fact we were perfectly unanimous when we met at my office, and we all signed that report.

679. *Mr. Hoyle.*] Can you tell us, Mr. Neale, whether any trial was made of these engines last Sunday? Yes; between Wallerawang and Mount Victoria.

680. Can you tell us whether any decision has been arrived at to reduce the boiler pressure on these engines? Not that I am aware of.

681. *Mr. Hoyle.*] I do not think I have any further questions to ask the witness.

682. *Mr. Brown.*] You handed in some specifications yesterday—were they the specifications of the engines you have now? Yes; as they were constructed for us.

683. Have you been able to find the other specifications—I mean those which were examined before the engines were ordered?—

684. *Mr. Eddy.*] I have handed in to-day—that is, the specifications before Mr. Neale had them altered—the amended specifications were put in yesterday, and the papers dealing with the deviations from the original specifications were handed in on the first day the Commission met.

685. *Mr. Hoyle.*] Did I understand the witness to say yesterday that after the engines arrived in the Colony he did not examine them to see that all the alterations which had been ordered were carried out? I examined one of the engines, but it is not my duty to examine each particular engine, but as a matter of fact I did, as I say, examine one of the class.

686. *Mr. Brown.*] He said that it was no part of his duty to do that particular work—that there were special persons appointed for that purpose.

687. *Professor Warren.*] Could you tell me the maximum weight on the driving wheels of these engines? I have not seen the engines weighed myself, nor have I conducted the weighing, so that I would prefer not to speak positively about the matter.

688. *Mr. Hoyle.*] (There being some delay in the attendance of the next witness) I have already suggested that it would, perhaps, have been better to have postponed this meeting, as, on account of the holiday and the increased pressure of work in the Department it will be difficult to secure the attendance of witnesses.

689. *Mr. Eddy.*] I have had to postpone six committees for this meeting of the Commission, and there is a great deal of work of the railways being put aside and delayed, in consequence of this inquiry. A lot of men are being put off work and a number of workmen are being discharged, such as carpenters and painters, in consequence of our work being delayed. The Commissioners should be on their tour to-day.

690. *Mr. Hoyle.*] Well, will the Commissioners consent to adjourn for a time?

691. *Mr. Eddy.*] No; not for a moment. This charge has been hanging too long over the Commissioners.

William Theodore Foxlee, M. Inst. C.E., Engineer-in-Chief of the Existing Lines of this Colony, being sworn, said :—

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692. *Mr. Eddy.*] Will you kindly ask the witness if he is a member of the Institution of Civil Engineers, and how long he has been connected with that body.

693. *President.*] Are you a Member of the Institution of Civil Engineers? How long have you been connected with that body? About twenty years, that is to say, I have been a member for eight years; but I have been associated with the institution for about eighteen or twenty years as a Student and Associate and Member.

694. How long have you been in the Railway Service of the Colony? Since the end of February, 1890.

695. And before that what experience had you in England? I was connected with the Great Eastern Railway Company for about four years, and with the London and North-western Company for about twelve or thirteen years, and before that I was with the London and South-western Railway Company. I began work in 1866, so that I have had from twenty-five to twenty-six years experience up to the present time; that is to say, about twenty-four years experience before I came here.

696. Will you tell us what was your last position on the English railways? I was Resident Engineer for the Essex Lines of the the Great Eastern Company.

697. *Mr. Hoyle.*] Will you kindly tell us when the Baldwin engines arrived in the Colony—do you remember their arrival here? I do.

698. Were any orders issued by you or your predecessor Mr. Angus, relative to the alteration of the platforms on the line? Orders were issued. The question of the alterations to the platforms and structures on the lines was, however, under consideration before I arrived in the Colony.

699. When was the order absolutely issued from your office? I am not quite certain as to that, but I am certain that it was issued before the Baldwin engines arrived in this Colony.

700. Were the alterations to the platforms actually commenced before the engines arrived in the Colony? Yes.

701. Can you tell us how long before? No, I cannot say exactly how long before.

702. Can you give the Commission any information as to how long a time elapsed between the commencement of the alterations and the arrival of the first engine? I believe the alterations to the platforms were actually put in hand during the latter part of May or the beginning of June last year.

703. Was that when the work was commenced. I do not mean when you issued the orders to the divisional engineers to have it done, but I want to know when this work itself was commenced? I cannot give you the exact date when the work was commenced, but I believe it was about the end of May or the beginning of June of last year.

704. Do you remember that there was a retaining-wall on the eastern side of the Eveleigh station before the work of quadruplication was begun? That wall, I believe, was removed to make room for the quadruplication? Yes.

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- 705-6. And the lines were made, and a new tunnel erected—I mean the skew arch? Yes.
707. Was a wall erected so as to form the eastern platform wall—I mean at the eastern side of the Eveleigh station? Yes; there was a wall there.
708. Was it pulled down, and re-erected a little further back? You are now referring, I presume, to the side of the new platform next the additional roads?
709. What I want to know is, was a wall erected to form the eastern wall of that platform? Yes; there is a wall there to-day.
710. But after the retaining-wall was pulled down was another wall erected? Are you referring to the retaining-wall?
711. No; the platform wall? Yes; there was a wall erected there, and the circumstances were these—there was a slight discrepancy on the side of the widened lines where the wall was built, and a portion of it was pulled down.
712. The whole length of the platform? Oh, no.
713. How much of it was pulled down? I cannot say, but I know a slight alteration was made.
714. Was it erected exactly the same distance from the railway as formerly? I believe it was; but I think, Mr. Hoyle, you are mixing up two things. We altered the grade under the skew arch, and the alteration of that grade necessitated a slight alteration to the platform wall. I think that is what you have in your mind.
715. When that alteration was made, Mr. Foxlee, do you say that the wall was pulled down, or was the road only lifted, the earthwork taken down, and the road dropped? I believe an alteration took place in the wall. To the best of my belief, a portion of it was sloped at the top, instead of being carried level.
716. You do not know whether it was erected the same distance from the rails as before? To the best of my belief it was.
717. Have you plans of the distance the rails next to the station were from the platform—plans which will show the distance between the rails and the platform before the platform was altered? —
718. *Mr. Brown.*] What are you seeking to obtain by this cross-examination, Mr. Hoyle?
719. *Mr. Hoyle.*] I want to show that a wall was erected before the quadruplication in widening the line, and subsequently, when the quadruplication was carried out, that wall had to be demolished. *To witness:*—Have you any information you can give me relative to these distances. Do you know the distance between the rails and the platform? I think I have some information here which may meet what you want. Eveleigh platform, original width from the centre of the road, 4 feet 10½ inches instead of 5 feet.
720. That is to say the platform was 1½ inches nearer the inner rail than it ought to have been? Yes, it would appear so if this information which refers to the distance between the old platform wall and the old line is correct.
721. Were you aware that these alterations took place to the suburban platforms at a time when it was known that quadruplication was going to be carried out? Yes.
722. Will you tell the Commission why it was that a number of the platforms had to be altered when afterwards they had to be destroyed?—
723. *President.*] What has this to do with the matter, Mr. Hoyle;—what do you wish to show by these facts?
724. *Mr. Hoyle.*] I wish to show that these alterations had to be made to meet the convenience of these engines. *To witness:*—Were they not made in view of these engines? They were made to give the necessary clearance to certain types of existing rolling stock, and also in view of the advent of a large number of Baldwin engines which were being constructed of a similar width. It was, in fact, thought that these platforms should be brought to gauge, so that there should not be any difficulty in working the rolling stock referred to, and also the Baldwin engines.
725. Then the Baldwin engines had something to do with the alterations? No. It was thought that in view of their coming here these station platforms which were out of gauge should be put to gauge.
726. You had the Baldwin engines in view then? Oh, certainly we had them in view.
727. *Mr. Eddy.*] Since so much has been said about the platforms and their cost I think it would be well if the Commission would ask the witness how much the cost really was.
728. *Mr. Brown.*] We had it in evidence.
729. *Mr. Eddy.*] That applies to alterations to the whole of the railways, but so much has been said about alterations first being made and afterwards demolished on account of the quadruplication that it would be well to have the cost given in these instances.
730. *President.*] What platforms were altered, Mr. Foxlee, which were subsequently removed?
731. *Mr. Foxlee.*] There were Newtown, Ashfield, and also a slight alteration at Macdonaldtown.
732. *Mr. Hoyle.*] And Granville.
733. *Mr. Foxlee.*] That has not been removed, although it has been altered.
734. *Mr. Eddy.*] Granville has not been removed. Can you give the Commission the cost of alterations made to platforms that have since been removed?
735. *Mr. Foxlee.*] At Macdonaldtown the cost was about £7; at Newtown, about £10; and at Ashfield, about £20.
736. *Professor Warren.*] That makes £37 in all—that is the cost of the alterations to the platforms which have been removed? Yes.
737. *President.*] I understand that what Mr. Hoyle wants to show is, what useful purpose was served by altering the platforms at a time when it was known they would subsequently be demolished. Then, I understand from you that there are only three stations at which this was the case? Yes.
738. *Mr. Hoyle.*] I have asked the witness if they had the Baldwin engines in view when these alterations were made; the witness said yes.
739. *Mr. Foxlee.*] We undoubtedly knew they were coming.
740. *President.*] What I understand Mr. Foxlee to mean is that looking at some of the engines here, and knowing that other engines of similar gauge were coming, they—the Commissioners—bearing both these things in mind, made the alterations to the platforms so that the traffic might not be obstructed.
741. *Mr. Foxlee.*] Might I explain this point a little further; the Chief Commissioner has pointed out that the Commissioners found on taking office that a large number of the structures on the railways were out of gauge. Early in 1889 directions were given that the whole question of gauge should be taken in hand,

hand, as the Commissioners felt themselves very much hampered in working the traffic since certain stock was restricted to certain portions of the line, and so it was determined to take the whole question in hand and ascertain what it would cost to bring the whole of the structures to the correct gauge.

742. *President.*] That is to say, the gauge originally laid down? Yes.

743. *Mr. Foxlee.*] Early in 1889, men were sent out to measure all structures, bridges, retaining-walls, lamp and signal-posts, and other works, as many as 8,000 or 10,000 measurements being taken over our 2,200 miles of road. That, of course, took a considerable time, and it was not till March, 1891, that we got the information, and that information when put in this form showed at once to the Commissioners that what they had learned was true, viz., that many platforms and other structures were grievously out of gauge. For example, the platform at one station was at the top 3 feet $\frac{1}{2}$ -inch from the inner edge of the rail to the outer edge of the platform; at another station it was 2 feet 5 $\frac{1}{2}$ inches; in another, 3 feet $\frac{1}{2}$ -inch, and so on; the standard distance being 2 feet 9 inches; there was in fact no kind of uniformity.

744. *Mr. Brown.*] Is it not necessary under the Board of Trade in England, that there should be some sort of uniformity observed in the various railway lines with regard to these matters? Yes; under the Board of Trade there is a standard distance of 2 feet 4 inches from the side of the widest vehicles above the top of the doors to the nearest standing work above platform level.

745. And you desire to conform in this Colony to that rule? Yes, as far as the existing structures will permit. What the Commissioners desire is to establish a rule here similar to the rule imposed by the Board of Trade in England, as far as practicable.

746. *President.*] This rule was only the result of what was found to be necessary for regulating the railways in England? Yes. Before a railway is opened in England it is submitted to a very rigid inspection by the Board of Trade Officials—the bridges are examined with great care; the heaviest engines are taken over the lines and bridges, each being tested by one of the Board of Trade officials; the workmanship is carefully examined, as well as the whole of the structures. The clearance of bridges and other structures is ascertained by taking the widest rolling stock over the line, opening the doors, and taking them past the piers and retaining walls, and thoroughly testing the clearance. The inspection before lines are allowed to be opened being most rigid.

747. *President.*] Is there any similar authority to the Board of Trade in this Colony? Yes; the Commissioners have instituted a similar system here.

748. Therefore, the inspection made by the Board of Trade in England is made here by the Commissioners themselves.

749. *Mr. Eddy.*] I will explain. The Commissioners put themselves in the position of the Board of Trade—and we lay down regulations for our own officers. That is what the Board of Trade do at home.

750. *President.*] They take upon themselves the responsibility of seeing that the rules of the Board of Trade in England are made applicable here.

751. *Mr. Foxlee.*] Yes; and that refers to the structures also in England. Before the Board there will allow a line to be opened for traffic, it requires that the rules laid down with regard to stresses on bridges and other structures have been complied with.

752. *Professor Warren.*] Otherwise the line would not be passed? Quite so.

753. And your evidence goes to show that these lines in their then condition would never have been passed? Undoubtedly—never in the world. The measurements we commenced in 1889 were only completed in March of last year; the whole had to be tabulated—so that there was not much time lost, since as already stated, we started the alterations at the end of May or beginning of June.

754. *Mr. Hoyle.*] Is it a fact that men were employed on nightwork, and also on Sunday to make these alterations? It may or may not be—all I know is, that I gave no such instructions.

755. Is it a fact that they were kept at work as I have described? I do not know.

756. *President.*] Supposing that they were at work night and day—why should not this course have been taken—surely the quicker the work was done the better, if it were necessary. I do not see the utility of your question.

757. *Mr. Hoyle.*] It seems that there was no danger in passing the station—the platforms were simply out of uniformity, but they did not strike the carriages.

758. *Mr. Eddy.*] I have before referred to the case of the carriage out of which a slice had to be taken in order to make it run past the platforms.

759. *Mr. Brown.*] You wish, I suppose Mr. Hoyle, to show that the Baldwin engines were responsible for these works being taken in hand?

760. *Mr. Hoyle.*] Yes, and that men were kept at work night and day upon the alterations. (To witness): Do you know that men worked night and day on these works and on Sundays also? They may have done, you will remember that this work had been under consideration for a long time, as far back as '89.

761. *Mr. Eddy.*] You will remember, sir, that I gave evidence that a large number of platforms were altered to the extent of several inches in 1879, on the Western line.

762. *Mr. Hoyle.*] As no danger existed to the rolling stock, and the traffic could be carried out by ordinary day work, will the witness say why men were kept at work day and night and on Sundays?

763. *Mr. Eddy.*] I would like to point out that the witness is being made to say things that he did not say, he simply said that he did not know that they had being kept at work in the manner described, and now Mr. Hoyle is assuming that the witness admitted that they were kept working at night and on Sundays. He is also assuming that the witness said that there was no danger to the rolling stock.

764. *Mr. Hoyle.*] I said that it had been stated that the men were kept working as I have said.

765. *Mr. Brown.*] Mr. Eddy, pray do not so far as you can help interrupt the examination.

766. *President.*] I suppose that really the reason why Mr. Eddy has interrupted is lest these statements might go forth to the public, otherwise it would not have mattered; such statements will not have the slightest effect upon me. I shall endeavour to find out for myself what the facts are, but I understood Mr. Eddy referred to the question lest it should go forth to the public, and he therefore desired to put the matter in a way which would not cause undue alarm.

767. *Mr. Hoyle.*] Do you know that at any time after the arrival of the Baldwin engines that one of these engines was taken down the South Coast line, and it was run past the platforms on that line as a trial? I believe there was an engine taken down the South Coast line—it may have been as a trial.

768. Were there any alterations made to the road after that? I am under the impression that one or two of the platforms were altered that were slightly out of gauge.

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769. Was it in consequence of the closeness with which these engines ran to the platforms, were these alterations made immediately after the trial? I believe one of the engines was taken down the line in order to ascertain if there was a proper clearance of the platforms. I believe alterations were made to the platforms at some of the stations which were not to gauge. No alteration would have been necessary if they had been in conformity with the standard gauge.
770. *President.*] When were the railway platforms built, were they done during the consulship of the present Commissioners? No.
771. *Mr. Hoyle.*] Were these platforms built by the Construction Department? Yes; a portion of them were built by the Construction Department.
772. Do you say this work passed through the hands of the Construction Department? Yes; a portion of it.
773. You only discovered that they were out of gauge when this engine passed through? I did not say that.
774. Were any measurements made as to the gauge of these particular platforms that the engine passed? I believe so. Measurements were taken, and amongst them occur the following: Kiama 2 ft. 7 $\frac{3}{4}$ in., Shell Harbour 2 ft. 8 in., Dapto 2 ft. 7 $\frac{1}{2}$ in., Bulli 2 ft. 5 $\frac{1}{4}$ in., Helensborough 2 ft. 8 in.
775. *Mr. Hoyle.*] Will you tell me the date on which these measurements were taken? They were taken before the Baldwin engines came here, they were completed by March, 1891.
776. Then why did you send an engine down—did you have any doubts about the matter? Not the slightest doubt; we sent the engine down because it was the easiest practicable way of finding out if the necessary clearance existed.
777. Before this engine went down to try the platform, were the alterations made before the new engine was put on the line? I am not prepared to say that they were; I am not quite sure about that; they may or may not have been.
778. When the engines were standing at the platforms were any measurements taken. I want the distance of the cylinder from the platform? I cannot tell you; I did not take the measurements myself.
779. Now, if an engine in passing at a slow rate of speed and clearing the platform would it also clear it when travelling at a high rate of speed? I do not know—it might.
780. Would not the oscillation make a difference?
781. *President.*] Is there more oscillation when the train is going fast than when it is going slow? Yes.
782. *Mr. Hoyle.*] You never tried the experiment in the case of these engines? No, but as practical men, when making lines of railway we know that a train rushing past at a high rate of speed will probably oscillate, and therefore we make an allowance to meet this.
783. *Mr. Hoyle.*] You had these platforms altered so that I understand no danger would occur? Yes; they were altered.
784. Was it on account of the oscillation, Mr. Foxlee? No, but because they were originally built to the wrong gauge.
785. Did you ever hear whether any of the cabs to these engines came into contact with any of the stations on the line? I know that some of the cabs of the new engines are not wider than some of the carriages on the lines.
786. Did any strike the platforms between Sydney and Kiama or Sydney and Newcastle? I occasionally have reports of verandahs having been struck, on account of their not having been built to the proper gauge, but I really cannot say whether it was due to the engines being at fault or not; I should not think so, because we have stock as wide over all as the cabs of any of the Baldwin engines.
787. *Professor Warren.*] You might put in the dimensions of the engines that were wider than the Baldwin engines.
788. *Mr. Hoyle.*] Of the cylinders also. You might give their dimensions? The 304 class of engine is the same width as the Baldwin engines were ordered over their cylinders.
789. *Professor Warren.*] Mr. Hoyle has stated that he would like to see dimensions of the cylinders in order that he might see how high they were; I think it would be as well to put in those dimensions.
790. *Mr. Foxlee.*] I will have that done.
791. *Mr. Brown.*] How many of that class 304 have you? I do not know.
792. *Professor Warren.*] With regard to the weight of the wheels, particularly the weight of the driving-wheel, what should be the minimum weight on the rail, do you know, as a matter of fact, the weight on the driving-wheels of the Baldwin locomotives.
793. *Mr. Hoyle.*] Will you have the total weights of both the passenger and consolidation engine put in?
794. *Professor Warren.*] 14 tons 7 cwt., that appears to be the weight on the trailing wheel of the passenger engine under the cab.
795. *Mr. Hoyle.*] What is the weight on the driving wheel?
796. *Professor Warren.*] There is one 15 tons 6 cwt. I see, and there is another 15 tons 9 cwt. in the consolidation engine.
797. *Mr. Hoyle.*] Have you the weights on both sides, Professor? Yes.
798. Do they tally? Yes.
799. *Mr. Brown.*] The total weight including steam and coal capacity you mean? Yes.
800. *Professor Warren.*] I see that the weight on the front wheel of the consolidation engine is 5 tons 16 cwt.; on the first of the driving wheels, 13 tons 17 cwt.; on the second of the driving wheels, 13 tons 14 cwt.; on the third of the driving wheel, 15 tons 9 cwt., and on the trailing wheel, 16 tons 15 cwt.
801. *Mr. Brown.*] These diagrams (*produced*) are by Mr. Thow, had you not better call him.
802. *Professor Warren.*] Assuming the weights to be as quoted, do you consider a 71-lb. rail to be heavy enough with the spacing we have in our permanent way? Yes, for safety, but we prefer an 80-lb. rail because it is more economical; you get nearly double the wear out of an 80-lb. rail that you do out of a 71-lb. rail.
803. *Mr. Brown.*] Then the life of the one rail is double that of the other? Yes, and it only costs about £111 more per mile for our road, laid with the heavier rail; and then we have also to take into consideration the saving in maintenance, as we get a stiffer road, and it follows, of course, where you have a better road there is less wear and tear on both rail and rolling stock.
804. *Professor Warren.*] Do you know the maximum weight on [the driving-wheels of the engines that are in use here? There are some heavier in the colonies than the Baldwin engines; 16 tons 7 cwt. is the heaviest here.

805. *Mr. Hoyle.*] Are those on the suburban tank engines? Yes. On the London and North Western Railway the weight of rail used to be 70 lb., then we increased it to 84 lb., and just as I was leaving England they were rolling 90-lb. rails, and now they are putting down some 100-lb. rails; the tendency all the world over is towards the adoption of a heavier rail. Not by compulsion of the state, but because companies find it more economical to do so. This is the case on the continent of Europe and also in America, not because it is safer, but because it is cheaper; and the whole tendency is in that direction. In Belgium, 105-lb. rails are used; in Germany the weight of rails has increased from 60 to 70 lb., and up to 80 lb.; and in France from 60 to 86 lb. The use of heavier rails saves in maintenance, more wear is got out of them, and a saving is effected in repairs to rolling stock. Universal experience shows that the heavier rails are more economical. With increased speed and increased weight of stock it is found cheaper to get heavier rails.

806. *Mr. Hoyle.*] Is there not some rule observed by engineers as to what is a safe weight in an engine to carry on a certain rail? If there is one thing more than another that is decided by experience only it is the details of permanent way. You might, for instance, calculate to an ounce the breaking weight of a rail resting upon supports at any given distance apart, but as in practice the supports (*i.e.* the sleepers) yield under the weight of passing trains, the calculation would be of no practical value.

807. *Professor Warren.*] It is a fact that the rail-head wears, and that you put more metal into it than is actually necessary for strength? Yes.

808. The actual carrying weight has nothing to do with it? Nothing at all.

809. *Mr. Hoyle.*] Has not the weight of the engine anything to do with the size of the rail? I do not say that. I say we do not reduce our rail to such dimensions that they are only safe to carry the rolling stock placed upon them. We know by experience what the weight of the rails should be in proportion to the weight of the rolling stock they have to carry.

810. Do you consider it would be safe to run a Baldwin consolidated engine at a high rate of speed over the Wagga Wagga viaduct? What do you call a high rate of speed?

811. Say 40 miles an hour? No; certainly it would not be.

812. Then it would not be safe to put the Baldwin engine at a rate of 40 miles an hour over the Wagga Wagga viaduct? Certainly not, nor any other engine; it would be a most mad thing to do.

813. Then at what rate of speed would you permit it to pass over that viaduct? All trains pass over the viaduct at a speed of 10 miles an hour, excepting where repairs are going on, when it is reduced to 4 miles an hour.

814. Have there ever been trains at a higher rate pass over it? Oh, yes; when it was built thirteen or fourteen years ago it was in a different condition.

815. *President.*] I know something about that viaduct. It is a place where considerable caution is required.

816. *Mr. Foxlee.*] Since this viaduct was constructed the weight of stock has considerably increased, and consequently does not give the same margin of safety as we should provide if we were building a new viaduct. The Wagga Wagga viaduct is one of the early structures.

817. *President.*] The rate you now go over is, I presume, a safe one to the public? Yes; perfectly safe.

818. *Mr. Hoyle.*] Would it be safe for these engines to pass over the bridge at a high rate of speed at Penrith—say 35 or 40 miles, or (say) even 20 miles an hour? Yes; I should think so.

819. Would it be safe for an engine weighing a hundred tons to pass over those viaducts? I think it would be perfectly safe to take one of the Baldwin engines over the Penrith viaduct at 20 miles an hour; but we have lowered the speed, inasmuch as we do not think it desirable to strain the girders unduly. It is one of the oldest bridges in the Colony. There is not the same margin of strength there as would be allowed in building a new one, and so we reduce the speed. By that we do not say that it is unsafe.

820. *Mr. Brown.*] But I understand you to say that the Baldwin engines are perfectly safe for the railways of New South Wales? Yes; I think so.

821. *Mr. Hoyle.*] Do you say that the Baldwin engines running on a 71-lb. rail, and at a high rate of speed a perfectly safe? I do.

822. By running at a high rate of speed would the extra employment of men be required? As a matter of fact we have not increased the strength of our gangs.

823. But you have not been running the Baldwin engines long? Well, as a matter of fact, wherever they are running we have not increased our gangs.

824. Have you found it necessary to effect any repairs of a more than ordinary character? No; the effect of these engines on our roads is much less injurious than that of two engines coupled together, which was the method adopted for working the traffic before the introduction of these engines. I have had a very careful watch kept as to the effect of these engines on the road, and the unanimous report has been that they have a much less injurious effect upon the permanent way, and that there is much less wear and tear than with two engines coupled together.

825. *President.*] Are the rails in one part of the line the same distance from each other as in another part of the line? No.

826. They are not uniform in that? There is no uniformity at all.

827. I cannot understand why all these platforms were originally of a different gauge;—are the different points on each side of the line uniform? No; there is no uniformity about them.

828. Here is a platform on one side—take Burwood for example—being the station that I know the best—here is the up line, there is the down line;—these two platforms are a certain distance from each other? They are.

829. Does not that distance obtain all the way through suburban stations? No; it varies in every station, and in the majority of cases the distance of each rail varies from the platform.

830. Ought they not to be the same distance from the platforms? Yes.

831. But, as I understand you, the platforms as well as the rails vary? Yes.

832. Where it is only a few inches even, it could not be through bad plate-laying or anything of that kind—by bad plate-laying I mean when the rails have been replaced in the course of repair? No; it is impossible.

833. The structures were badly built at first? Yes; every man seems to have gone upon his own bent.

834. *Professor Warren.*] There is no uniformity? No uniformity at all.

835. *President.*] Was that not a most serious thing? Yes; a most serious thing.

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836. Somebody, I suppose, understood railway management when this was done; I cannot understand a thing like that;—it strikes me as being a serious matter? Part of the work was carried out by the Construction Department, and generally that work was to gauge, though I have mentioned a few instances in which it was not. Then on the other lines, a number of structures were carried out by the Existing Lines officers.

837. I want to know this;—was the difference in gauge confined only to the line between Sydney and Parramatta, because that was the first portion of the New South Wales railways to be constructed, and I could have understood it on that account? No; the want of uniformity exists throughout the lines. I was going to explain that I am informed that certain parts of the work were carried out by the Existing Lines Branch, and others by divisional and other engineers connected with the Existing Lines Branch, and that it was structures put up by this Branch that were generally at fault.

838. *Mr. Brown.*] The immunity from accident that has prevailed in the past would probably have prevailed all along, so that as I understand it the alterations have been carried out according to your evidence merely as a matter of uniformity as far as the Department is concerned.

839. *Mr. Hoyle.*] I took the South Coast line as an example, because it is one of the last lines constructed, and the platforms there were built by the Construction Department. I would like to ask Mr. Foxlee what is the extent of the double line on the Illawarra railway? The double line extends as far as Waterfall.

840. Beyond that there is a single track? Yes.

841. Do you know whether any of these platforms were chipped or cut in any way beyond Waterfall, or whether the line was set back inasmuch as it was a single line? Speaking generally, and without accurate data respecting each particular platform, you may take it from me that if it was possible to slew the road, that would be done, but if there was anything to prevent the road being slewed, we should naturally cut the platform.

842. As it was only a single line, what would prevent you slewed it in every instance? Take Otford, for instance—although I am not sure that any alteration was effected there—you have a curve of 10 chains radius between the station and the tunnel, and it would have been impossible to slew the line in that instance. You have a 10-chain curve already, and if you slewed it over you would cripple your curve.

843. Is that an isolated case? No; but if you will give me any case in which we have chipped a platform instead of slewed the road, and I can tell you why it was done.

844. But was not the platform built in accordance with the orders of the Construction Department? I believe so.

845. If that was so, have you any reason to believe that the rails had not really moved in towards the station? As I have already stated, I am not quite sure whether any alteration was made at Otford at all, but speaking generally, it is quite possible that where the rails were found too near a platform, they had become slewed from their original position, and in that case we should give them the necessary clearance by slewed them back.

846. And all that was done after the Baldwin engines, to which reference has been made, went down the line? That I am not prepared to say.

847. Can you give us the date upon which the engine went down the South Coast line, and also the date upon which the platforms were altered? I will find that out for you.

William Thow, Chief Mechanical Engineer, called in and sworn:—

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848. *President.*] How long have you held your present position? Nearly three years.

849. What had you been before that? I was twelve and a half years in a similar position in South Australia, and before coming to South Australia I was with Sir John Fowler for five and a half years, connected with his office in Westminster. Previous to that I was at Crewe, in the London and North-Western Railway works, and in one or two contract shops—Dübs', of Glasgow, and the Worcester Engine Works, as draughtsman.

850. So altogether how many years' experience have you had? Thirty-two years.

851. Are you a member of the Institute of Civil Engineers? Yes, and a member of the Institute of Mechanical Engineers also.

852. *Mr. Hoyle.*] I would like to ask Mr Thow this question: You were not in the Colony, were you, when the order was sent to America for Baldwin engines? No.

853. You had gone to England, I understand, in connection with some business for the Department? Yes.

854. Was that business connected with the Baldwin engines? No.

855. Did you visit the Baldwin works in America, on your way back to Sydney? Yes.

856. Did you see the engines that have been brought into the service from the Baldwin Works, when they were under construction? No, I only saw some of the material. No parts of the engines were put together. Some of the materials were delivered, and they were beginning to put them together. For instance, they had none of the boilers put together, though they had some of the boiler plates ready for being put together.

857. Were you consulted as to the importation of these engines? I could not be consulted; I was not in the Colony at the time.

858. But was the importation of these particular engines suggested to you before you left the Colony? No.

859. You never heard anything about their importation at all? Not until I was in England.

860. What instructions did you receive in England in regard to them? To look up the Baldwin people when I passed through America, and to see how they were getting on, and to advise them with regard to our particular features.

861. Was that communication sent to you in the form of a letter or a cablegram? I think I had both.

862. *President.*] What was the purport of the cablegram? Simply to call at the works and see how they were getting on with the order, and there were also some particulars sent to me of the order by letter, I remember that distinctly.

863. *Mr. Hoyle.*] Will you state what those particulars were? I cannot; I have not looked into the matter since; however I can ascertain that for you later on.

864. Was this the first intimation you had with regard to the Baldwin engines? Yes.

865. Had you been consulted in regard to this particular engine before you left for England—would you have advised the Department to bring them here? That would have depended upon circumstances entirely.

866. But would you, as Locomotive Engineer, have consented to an order similar to this? I say that would depend entirely upon circumstances. The circumstances are these. If we required the engines at once, and the Baldwin people were the only people who could deliver them in time, then I should say we must go to the Baldwin people for them.

867. Do you then consider these engines were not required? When?

868. At the time you were in England? Certainly not.

869. *President.*] When did you leave New South Wales to go to England? I think it was on the 10th August, 1890.

870. At that time the Baldwin engines were not ordered? They were certainly not ordered.

871. When did you hear in England that they had been ordered? I think at about the middle of October or the end of October, I think that would be about the time I got the first intimation.

872. *Mr. Hoyle.*] When did you get that cablegram—was the intimation you have referred to sent by that? No, I do not know that I got that by cable; there were certain messages sent to me, but I think they arrived either when I was in America, or just about the time I was leaving England for America.

873. *Mr. Eddy.*] You have ruled, Sir, previously that you would not admit evidence in regard to the necessity of these engines, and as this question is dealing purely with the necessity of these engines I presume you will not admit it.

874. *President.*] I take it that these questions are coming to the point of whether the engines are suitable to the permanent way. I take it that is what Mr. Hoyle is coming to.

875. *Mr. Eddy.*] He has been asked whether he would have ordered them—that is a question for the Railway Commissioners and not for Mr. Thow.

876. *President.*] You are quite right there, Mr. Eddy.

877. *Mr. Hoyle.*] Since you have returned to the Colony have you examined these engines? Yes.

878. Will you state to the Commission your opinions upon them? In what respect?

879. First let me ask you whether these engines were the cause of any correspondence between yourself and the Railway Commissioners upon your return? I do not think so.

880. Have you had any correspondence with them? Oh, I have reported to them the results obtained from the engines.

881. But did you make any comments to the Commissioners as to the suitability or unsuitability of the engines?

882. *President.*] If you can prove by this witness that he himself thinks them unsuitable, and get him to give his reasons for doing so, that will be of much more use than anything he may have said to the Commissioners. Questions regarding anything he has said to the Commissioners would be put solely for the purpose of cross-examining him if he were a hostile witness and had said something at variance with the statements he had made to the Commissioners.

883. *Mr. Hoyle.*] Did you examine the engines? Yes, I saw them being erected.

884. Did you examine their parts? Yes, I examined all their parts.

885. Do you know what the specifications for these engines contained? I think I have seen the specifications.

886. When you were examining these engines, had you the specifications before you to see that all the details were carried out? I think I had.

887. And were the specifications carried out? I believe they were.

888. Did you find any defects in the engines? In what respect?

889. In any respect? When they had been at work we found that the axles gave trouble.

890. Were the axles examined by you before they ran? Yes.

891. Did you consider these engines suitable for the work they had to do? Certainly; they are suitable for hauling heavy loads.

892. What is your opinion about the wheels of these engines—in any engine you design would you have put similar wheels? All my practice has been English practice. These are American engines.

893. Would you put such a kind of wheel as this on an engine? I would not specify American wheels for English engines. All my practice has been amongst English engines.

894. Have you any objection to state why you would not specify American wheels? Merely because I would be putting different parts of different engines altogether, which would be very unusual. I should certainly try as far as I could to make a uniform machine.

895. But would you put a wheel on an engine you had designed as light as these wheels are? In what respect, are they light?

896. The spokes and the bosses of the wheels are light? I would make stronger spokes.

897. You do not think that these spokes are strong enough? I said I would put stronger spokes in a wheel that I was designing.

898. *President.*] That is to say if you were building an engine for yourself, but take this engine? If Mr. Hoyle wants to know if I have seen any breakages in the wheels of the Baldwin engines, I say at once that I have not.

899. But are you in a position to say the wheels are defective in any way, are the wheels too light for the rest of the engine? I have not seen any defects in the wheels in the form of breakages. The wheels, I admit at once, are manufactured very roughly, they are very rough pieces of forged work, but that they are defective and not strong enough for the work they have to do, I am not prepared to say.

900. You mean to say that they are not so well finished as the wheels on English locomotives generally are? They are not so well finished as wheels that come out of an English workshop.

901. *Professor Warren.*] It has been said that these wheels have been made by an adaptation of an old process, that was stated in evidence yesterday;—do you consider that process suitable for the manufacture of wheels? The process is somewhat similar to a process worked for a long time at Rotherham for carriage and waggon wheels. It is a stamp process. The spokes are made of rolled-iron, and they put the hub of the wheels on to the spokes in two pieces, and place the whole thing in a furnace, taking it out at a welding heat and pressing it together by hydraulic presses, or with large steam-hammers.

902. Have you any objection to the process? I think it is a very good process for the production of this particular wheel.

903. *Mr. Hoyle.*] But do you consider the wheel heavy enough in the spokes to carry the weight it has to carry in these engines? If it were not heavy enough we should have seen signs of its giving way, and, as a matter of fact we have not detected anything amiss with the wheels.

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904. You have not detected any defects in them? We have not detected any defects in this particular wheel.
905. Did you see an axle that broke on a train as it was coming into Sydney Railway Station? Yes; within a few minutes of its breaking.
906. Were any tests made? Yes.
907. Can you give any reason why the axle broke? Yes; my opinion is that it broke because it was of very bad material.
908. Was it through over-heating? I do not think so. The heating that it did receive would no doubt increase the weakness of the axle. It would no doubt cause it to give way a little sooner than it would have done had it been quite cold.
909. Was the axle twisted in any way? No, it was a clean break. In extension of that answer, I may say that there is no doubt that the axle had made a clean break, but that the two surfaces had for a few seconds rubbed together, which might have produced an appearance of twisting. There was no doubt an appearance of twisting, but that would be due, I think, to the fact of the parts rubbing together.
910. Were there any other axles broken? Yes; three bogie axles and two tender axles broke.
911. In Sydney, or whilst the trains were in motion? A tender axle broke in Newcastle. One of the bogie axles broke in Sydney, one at Yass, and one at Junee.
912. And when you previously examined these axles, had you any reason to believe that they were unsafe? No, none whatever.
913. Can you, as an engineer, tell us why, in your opinion, it was necessary to put into the bogies larger axles than the original iron axles—that is, when they were replaced by steel axles? Because it has always been my practice to use larger axles.
914. And you bored out the boss of the wheel? Yes.
915. To admit of larger axles? Yes.
916. That weakened the boss, I suppose? It would make it slightly weaker.
917. And when that was done a face was put on the wheel, and a wrought-iron ring round the boss? Yes. I have a tracing here which will explain matters. (*Tracing exhibited.*)
918. Do you consider that to be a safe practice? A very safe practice. Let me explain. This is the hub of the wheel. The hole, previous to the boss being bored out, was 5 inches in diameter. We bored it to 6 inches in diameter to admit the new axle; then we turned the outside edges of the boss, and shrank on a pair of rings to hold the wheel together in the event of its giving way.
919. *Professor Warren.*] To compensate for the material that you cut away in boring out for the larger diameter? Yes, but especially to hold the wheel in the event of its giving way. This being a cast-iron boss it would fracture without giving any warning, or at all events with very little warning, but by having the rings shrunk on in this way, if a fracture did take place it would hold together. This wheel is not like a coupled wheel; it is simply a roller, and has nothing to do but to roll along the line and carry the weight which may be transmitted from the axle.
920. *Mr. Hoyle.*] Do you know upon which train the axle broke, was it on the Northern express? Yes, on the Newcastle train quite close to the Sydney platform.
921. The train was going at a low rate of speed? Very low.
922. What would have been the result if the train had been travelling at the rate of 30 miles an hour? It is very difficult to say.
923. Do you mean to say that it would have turned the engine over? It is a very difficult thing to speculate upon. It is a very nasty accident to happen, and I should not like to see it happen again anywhere.
924. Since the engines have been running, do you know whether the repairs to them have been very great? They have been rather heavy, not particularly so.
925. Do you think the repairs that have been done to these engines are greater than they ought to have been considering the mileage run? They are greater than the repairs to some of the engines that we have, but not greater than the repairs to others.
926. But are they greater than they ought to have been to a new engine running at the rate these engines have been running? It all depends upon the type of engine.
927. *Professor Warren.*] Your experience is mostly in reference to English engines. Suppose we compare engines of the English and American types, in a majority of them would you have required to expend as much money upon repairs in a similar length of time provided of course that the English engines were a similar size, and had been running the same mileage? No, I do not think that we should.
928. There would be a considerable difference you think? No, there might not be a very considerable difference, but I do not think that under similar circumstances English engines would have come into the shop so often as these have.
929. It is rather early in the day to talk about repairs, is it not? Yes; that is what I say. It will take years before we can compare the costs of these engines with the cost of English engines. Engines are not worn out in a very short time, and it is not an uncommon thing for all engines to come into the shop more or less when first they begin to run; they have to shake down to their work, and there are several little details that must be attended to in order to bring them to their proper bearings.
930. Do you consider that the bearing service is sufficient in the axle-box? In the driving or coupled axle-boxes certainly it is ample.
931. You are speaking now of the engines? Yes. In the coupled axles the bearing surfaces are excellent. I would have preferred more in the bogie if I had designed the engines.
932. Was that the reason why you increased the diameter of the axle? Yes.
933. Not to give greater strength to the axle, but to give more bearing area? Yes; because they were running hot.
934. You consider that the chief cause of heating was the want of bearing space? No; I consider that it was the dirt that was in the axle. The axle had not been fairly worked; the dirt had not been sufficiently squeezed out when the metal was in a malleable state, and the consequence was that it was continually oozing out when the axle was at work, and irritating the brass bearings. If they had been made of excellent material I think they might have been running to-day.
935. Yorkshire scrap? Yes; Yorkshire scrap or any other clean material.
936. Do you think the lubrication was sufficient? Yes; I do not think it was for want of oil that these axles gave trouble.

937. Have you made any experiments in that direction? Yes; we tried several methods of improving the axles before they were changed. We put on additional oil boxes in the hope that in that way we could remedy the defect.

938. You tried to improve the axles? Yes; we tried several plans of getting the axles to run cool before they broke, and it was a mystery to me why they did not run cool; I could not understand it until we pulled the material apart in the testing machine and then the secret was revealed.

939. *President.*] And that was the very bad stuff that had been put into the axles? Yes; it was inferior material, there is no doubt about that.

940. Very inferior material to put into such an important part of a locomotive? I think so.

941. *Mr. Brown.*] Could any reasonable supervision or care have prevented this accident? No; the only means of knowing what was in the axle was to pull it to pieces in the testing machine or to break it by the drop test.

942. And that is not a usual thing to do, is it? Oh dear, no; it would destroy the axles.

943. *Professor Warren.*] You do not mean that if the axles had been properly made, whether of iron or steel, you would be liable to have a bad accident. You would not expect a Yorkshire scrap or steel axle to turn out badly? We do not find that to be the case.

944. Axle material should be the finest and best that can be produced? Yes; it certainly should.

945. *Mr. Brown.*] No inspection or supervision on the part of yourself or anybody else in the Railway Department could have prevented this accident to the axle? No; it would have been impossible to tell that the axles were bad until they had been pulled or broken to pieces.

946. *Professor Warren.*] You do not mean to say that if you had been at the Baldwin works and seen these engines manufactured that you could not have told that they were not up to the mark. You say that there was a good deal of dirt in the material which shows that there was insufficient welding? No doubt in the process of manufacture a person might have seen that the axles were not getting fair treatment, but when they arrived here they were perfectly bright. They looked all right. My attention was drawn to various parts of the engines, but not to a single axle. Not a single axle raised doubt in the minds of any of my officers or in my own mind, and it was only when the axles were running hot that we adopted means such as increased lubrication to keep them cool. It was only by putting the axles in the testing machine and under the drop test that we found that they had been made of bad material.

947. You stated that you were with Sir John Fowler in England, and he is the Inspecting Engineer for the New South Wales Government. I take it that Sir John Fowler thoroughly inspects all engines, bridges, and other materials that are afterwards sent to this colony? I presume he does in the case of matters which are put into his hands.

948. You have lately imported some engines from English manufacturers? Yes.

949. Were they tested by Sir John Fowler and his staff? Yes, his office had the inspection in their hands.

950. The materials of the axles and other parts of the engines were tested I presume? Yes.

951. It was specified that they should be? Yes.

952. And the engines were tested in steam afterwards? Yes.

953. There is a specification here which I would like to read to you because it is certainly to me peculiar "Axles of hammered iron or steel." "To be made a true cylinder and carefully fitted," that is all. Is that a sufficient specification to obtain a suitable axle. There are no tests specified? You will not find I think in any Baldwin specifications anything else than that. That is my experience.

954. Do you believe in trusting to the honor of the manufacturer to produce the best axles from the best class of material? I should certainly have expected from the Baldwin people very much better axles than came out with these engines.

955. But that is not my question. I was asking whether you trusted to the honor of the manufacturers to produce axles from the best material rather than specify that they should undergo tensile tests, ductility tests, and drop tests? Well, I tell you that my practice has been all English practice, and in English practice we do subject axles to those tests, and specify them too; but I believe that if we were to go to America to-morrow or send such a specification as commonly used for English engines the Baldwin Company would not submit to it. They furnish their own specifications and it is very rarely that American Railway Companies issue such specifications as English builders accept. They are only beginning to do so now. I had a conversation with Mr. Ely, Chief of the Locomotive Department of the Pennsylvania Railway, and he showed me parts of his specifications which, for America, were unusually stringent and told me that although that was his practice it was an unusual one.

956. Is it not your general practice to specify full and complete tests? Yes it is.

957. You have never written a specification for locomotives in which you have not specified the materials? No, or given them afterwards, because it is the English practice to specify them, and English makers expect it.

958. Was there any inspection of the American engines similar to that which would have been the case in regard to an engine manufactured in England? Not that I am aware of.

959. *Mr. Eddy.*] Was not Mr. Thow authorised to appoint such an inspector when he was in America if he thought it desirable, and did he not decide, and cable the Commissioners that it was not the practice in America to do it, and that it would cause difficulty? Yes; I did. I had instructions from the Commissioners when I was in America to consider the question of appointing an inspector, and when I went to the Baldwin firm I inquired into their conditions for this contract, and with the information that I obtained I then consulted with our agents in New York to ascertain what the practice was with regard to the building of locomotives there, because I knew that they had had some experience in that particular work, and they told me that it was very unusual to have any inspector over the engines when built by a firm like the Baldwin Company. I had to consider what I had to put before an inspector to guide him in the matter. As I daresay you know, it was left with the Baldwin people to supply engines in accordance with their best practice. I could not give a specification or a set of drawings to the inspector. I could not tell him, "There are your instructions, which you must carry out." All these things were considered by myself and the agents, and the conclusion that was come to was this: That under the contract the onus rested with the Baldwin people to supply these engines of the best character possible, and if an inspector, without sufficient guidance, was to interfere, the onus would be removed from them to a considerable extent.

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960. You mean to say that, responsibility being removed from the Baldwin Engine Company, you would have been left with no guarantee beyond an unsatisfactory inspection? Well, I mean that the company would not have felt that the onus rested on them so much if we had appointed an inspector at that time.

961. You mean that, if you had appointed an inspector, the Baldwin Company would have felt that it was the look-out of the New South Wales Commissioners, and that it was no question of honor as to them? That would have been the tendency, no doubt, and the agents instanced a case known to me of rolling-stock supplied by American builders. They reminded me that they had Mr. So-and-so as the inspector, and said, "We know that he took the money he charged without doing any more than going to the works occasionally, and saying 'How do you do?' and leaving the matter with the makers. He exercised no real control."

962. *Mr. Brown.*] We understand from Mr. Eddy that the Baldwin Company accepted the full responsibility in regard to these defects? They have in regard to the axles, and with regard to other things besides.

963. So in that way they justified your argument that if left to their honor they would take the responsibility for the work being done properly, and it was better not to appoint an inspector, who would have had insufficient data to work by? Yes.

964. *President.*] You mean to say that the Baldwin Company are strong enough to say, "You must trust us to produce the best work," and, being strong enough to say that, in this instance they put in bad axles? I do not suppose that they did it intentionally. They may not have made the axles.

965. *Mr. Eddy.*] We find that they obtained the axles from the manufacturer who had been in the habit of supplying axles to them, and who had never failed them before. The Baldwin Company build 1,000 engines a year. More than twice as many as any English firm.

966. *Professor Warren.*] You have replaced the iron axles with steel axles?

967. *Witness.*] Yes.

968. What steel have you used? There were twenty-four replaced, and six of them are of steel manufactured by Vickers & Co., of Sheffield, and the rest are of steel sent out by the Baldwin Company. The reason we used the Vickers steel is this:—We wanted the engines, and we obtained six axles from Victoria—made of Vickers steel. We put those in the first engines which failed, and in the meantime the Baldwin people had shipped 24 steel axles so that we obtained the full complement from the Baldwin firm without any charge.

969. What kind of steel did they send out? "Otis" steel, that is a very well-known American firm; a firm as well known as Vickers in England, or Krupp in Germany.

970. How do you know that the steel axles are all right? We do not find that they give us any trouble.

971. *President.*] They do not heat as the others did, I suppose? No; they are running very well without giving us any trouble.

972. There is a point that I think the Commission ought to get at with regard to coal consumption;—I know it is a difficult matter, and we might have to give it up, but could you suggest any way in which the coal consumption could be got at in the Baldwin engines, and compared with the performances in English engines? We can give the records of the coal consumed.

973. *Mr. Eddy.*] Is it really necessary that a question like that should be gone into. What has that to do with the permanent-way of New South Wales and the engines not doing their work. We are ready to give any information that we can to the Commission, but there is such a loss to the country through the Commissioners being kept here day after day that I should like the evidence to be kept as far as possible within the four corners of the inquiry.

974. *Professor Warren.*] But suppose that it should turn out that the American engines are unduly extravagant—would not that be a defect?

975. *Mr. Eddy.*] This is the first time that I have heard the question of coal consumption raised. There is no charge of that nature before us. A defect is a defect in the machine, the coal consumption has no bearing upon it.

976. *Professor Warren.*] I do not take that view at all. If the engines were badly constructed, and had insufficient heating surface, and there is a great deal more friction in the movement of various parts than ought to be the case, then they certainly would consume very much more coal. Then the manner of design and construction would also affect the coal consumption. The amount of coal consumed is a very difficult matter to get at, I know, but I should like to get at it if possible.

977. *President.*] Professor Warren is really the expert Commissioner upon this Commission. You, Mr. Eddy, think that a question of coal consumption is not material, he thinks it is, and surely you cannot think that I am going to say that something that Professor Warren—who is here to advise myself and my colleague—thinks material is not material. I cannot enter into the matter at all.

978. *Professor Warren.*] I think the matter is distinctly between the four corners of the inquiry, whatever the Commissioner may think, and I only wish to get the facts of the case.

979. *Witness.*] I think we can supply you with information.

980. Have you made any tests of the engines, have you put an indicator on? No.

981. Have you made any tests as to the evaporation of the water? No.

982. You have made tests with regard to American engines in South Australia, I believe? Yes.

983. Did those engines in South Australia consume more coal than the English engines that you have running there? Yes, they did.

984. Was the evaporation per pound of fuel greater or less in the American engines than in the English engines? It was less in South Australia at the time we made the tests.

985. And you have never made any tests of that character here? No, we have not.

986. There has been a great deal said about these engines;—do you not think it would be very desirable to ascertain the evaporation, the coal consumption, and the power developed? Well, it might be interesting as a scientific question, but for the practical work of railways, with which we have a great deal to do just now, I do not think it material.

987. Why did you indicate the engines in South Australia, merely as a scientific test? Yes, and for a special purpose; but not merely to inform myself of the coal consumption of those engines. It was really for the special purpose of an inquiry, rather than for railway purposes.

988. Then you did not consider it necessary to determine the evaporative efficiency in South Australia, excepting as a matter of curiosity? The evaporative power of the engines was ascertained, but it was

not

not done in the way in which you would probably consider it necessary to do it as a scientific experiment. We did it roughly by ascertaining the quantity of water evaporated by a known quantity of coal consumed over a long period, and we referred the result to the basis of 100 tons hauled 1 mile.

988½. Have you noticed anywhere any side play in the Baldwin engines. Have the axle-boxes cut into the wheels? No; the axle-boxes have themselves been cut into by the wheels in one or two instances.

989. Would you ask the witness whether the consumption of coal in a locomotive has any bearing upon the load hauled, and whether, without taking that into consideration, it is possible to compare the coal burnt by one locomotive with the coal consumption of another locomotive? It is the coal consumed in relation to load hauled that is the test. The question is the amount of coal burnt per 100 tons hauled per mile.

990. *Professor Warren.*] I spoke just now of indicator diagrams;—would not that be a test of the power developed? Yes; you would then get the actual horse-power.

991. I suppose you could give us some information about it? Yes, we could; but it would be rather unsatisfactory from your point of view, because not only has the load a great deal to do with the consumption; but supposing two engines are taking different loads, you can only make comparisons if they move at the same speed. That is to say, you could compare the consumption per 100 tons per mile if the speeds were the same; but if you have engines running at different speeds over the same road and with different loads, it is a very difficult thing to equate. It must be referred to horse-power. If you wanted to make a scientific test of the coal consumed it would take a long time, and you would have to devote a very large amount of labour to it. For rough purposes we could give you a good deal of information.

992. That is all I want. I do not want anything in the nature of a steam-engine test? Yes; but if you were to draw any conclusion from the information we are now able to supply, I am afraid it may be questioned. We can get some data, but it will take a long time and a great deal of work to produce an exact comparison.

993. *Mr. Eddy.*] Is it not a fact that the Commissioners have for some time been trying to get information of that kind for their own guidance, but that with the large amount of other work of a more important character in the Department we have not been able to do so yet? Yes, that is the case.

994. *Mr. Hoyle.*] Is it not a fact that you are raising the tender of some of these engines to create additional water capacity? We have altered one as an experiment.

995. Have you examined any of these engines lately? Yes.

996. Have you found in any of them any undue wear of the cross-head slides? I do not know whether you should call it undue wear—there is an apparent wear.

997. Have you not had to put brass liners in? Yes, or to bring the slide-bars together, which comes to exactly the same thing.

998. But have you any engines in which you have put brass liners in such a short time as these engines have been running? Yes, I am sure we have; but you must remember this,—these are very powerful engines, and you cannot get power without destruction—that is impossible; and if you want to compare a very powerful engine with an engine that is only half or 50 per cent. as powerful, then you must expect to find a difference in the wear and tear of the engines. You cannot possibly avoid that.

999. Is there anything wrong with the reversing gear of these engines? Yes; it has given trouble in some respects.

1000. Is it your intention to alter the reversing gear of these engines, or to renew it? It is our intention to strengthen it.

1001. Will that be done at the cost of the Baldwin Company? I think so. We have done something of the kind already and it has been paid for by them.

1002. Is it your intention to do that in regard to all the engines? I believe we shall do it in regard to all the engines.

1003. Has there been much trouble or work in connection with the tubes of the engines? No, not much. We had a little trouble at first, but I think that was chiefly due to want of attention on the part of drivers, because we have had no trouble lately.

1004. Have you put, or is it the intention of the Department to put, new steel axles into all the tenders of these engines as well as into the bogies? We have put a number of steel axles into the tenders, and, as they require it, we shall put steel axles into the others.

1005. You intend to put them in all? We do ultimately.

1006. And will the whole cost of it be charged to the Baldwin Company? Certainly, so far as the passenger engines are concerned.

1007. And how about the Consolidation engines—have you not had to do the same with regard to them? In some instances we have, and up to the present we have charged the cost to the Baldwin people.

1008. Is this charge being deducted from any money of the Baldwin people that is held by the Department? Yes, we still hold money of theirs.

1009. *Mr. Brown.*] That is hardly fair. The witness tells us that the expense is being defrayed by the Baldwin Company, and that is sufficient without going into the question of the way in which the money is being paid.

1010. *Mr. Hoyle.*] Do you know whether any of these engines were lifted when they went to Newcastle? Yes, some of them were lifted because their axles ran hot.

1011. Were they lifted often? I do not know that they were lifted often. We very frequently lift engines or tenders for that reason.

1012. Did it come to your knowledge that there was any play between the bosses of the wheels on both sides of the engines running north? There always is some play, even when engines are sent out new.

1013. Was there any play between the swing of the bearings? I do not understand the question.

1014. Were many of these draw-bars broken? I only know of two, but we have changed the draw-bars, and charged the cost against the Baldwin Company.

1015. All the draw-bars were taken off? Yes; and we put new ones on.

1016. New ones, of additional strength, I presume? Yes.

1017. And have any of these new and stronger ones broken? I have not heard of any of them breaking.

1018. Are these reports supposed to be made to you as Chief Mechanical Engineer? Yes; I generally know of anything that is peculiar in that way.

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1019. Do you know whether there is a fitter and his mate told off at Bathurst to look after these engine particularly? It is quite likely that there is. We split up our fitters in different ways. Men used to one class of engine are generally employed upon that class, because we get our work done better in that way.

1020. Have you heard if any of the foundation rings were defective? I heard of one that was leaking and I expect leakages sometimes in boilers in such things as fire-hole rings or foundation rings, no matter where they come from.

1021. How many men are on these engines? Three men are on the American engines.

1022. *Mr. Eddy.*] Has it not been a practice always in the Colony to put three men on American engines—there are a large number of American engines at work? Oh, yes; ever since the American engines of similar design have been working in the Colony three men have been employed upon them. The Consolidation engines, before the arrival of the Baldwin engines, had three men upon them.

1023. Are the American engines of the 304 class driven by three men? That is not Consolidation engines at all. There are not three men employed upon them.

1024. Are there three men employed on the Mogul engines? No; that is a different type of engine.

1025. Are three men employed on the 232 (? 294) class? No; that is a smaller engine, and smaller engines do not require three men. But when we have large engines it takes one man more to keep up the fire. Two men are employed in looking after the fire, and one in driving the engine, and if you have an engine giving off the power of two small engines, you must expect to have two firemen to keep the fire going.

1026. *Mr. Eddy, to Mr. Hoyle.*] We will take the second fireman off to-morrow, if you like.

1027. *Mr. Hoyle.*] Oh, that is the business of the Railway Commissioners. They will not be dictated to by me as to how they will work the railways. *To witness:*—Are the fire-boxes as large as the fire-boxes in ordinary engines? Much larger.

1028. And does it not follow that there would be a larger draught and a greater consumption of coal? Certainly.

1029. Do you think that the power in this fire-box is too large? Certainly not. It is a well-proportioned box. I consider that no fault can be found with the grate area.

1030. In examining these fire-boxes, did you notice any test-mark? I do not remember that there was any.

1031. Is it customary to put a test-brand on the fire-box—I mean a maker's test-brand? I never saw one.

1032. But is it customary in your Department to put brands on the boilers? Yes; we do it for our own information, but I never saw it on boilers tested by the makers. They are never marked in that way.

1033. Is it a fact that the goods Consolidation engines are running the passenger trains? Yes.

1034. How far do they take it? From Penrith to Katoomba.

1035. How is it that they do not take it further than Katoomba? They are not required.

1036. Why are they not required? Because the line is of a less mountainous character. It is only because the engines are capable of taking a load up the very steep parts of the incline between Penrith and Katoomba by themselves that they are employed there.

1037. What is the general load that the traffic justifies as far at Katoomba? The Consolidation engines carry a load of about 145 or 150 tons behind them. I should say 145 tons.

1038. And what engine then takes the train on to Bathurst? Sometimes one and sometimes another of the old class.

1039. Do any of the Baldwin passenger engines ever take the train on to Bathurst? Sometimes.

1040. Can you tell me why the Baldwin passenger engines are not employed in taking the train from Penrith to Katoomba? Because we found the other more suitable, being more powerful.

1041. I understand that they were brought here to run the heavy traffic? Yes; and they are doing it now.

1042. Then can you tell me why they do not run the heavy trains up the Zig Zag and on to Katoomba? I should think that it was a very peculiar restriction if we had to employ Baldwin passenger engines on all heavy loads. We employ them on work for which they are best suited.

1043. Could the Baldwin passenger engines take the trains up the steep gradients as well as the Baldwin Consolidation engines? You ask me a question very like this, "Can a donkey draw as much as a draught horse?" Certainly not; the Baldwin engines were intended for certain work, and for that work they are used.

1044. What were they intended for? To run on other parts of the railway system and on those parts of the railway system they are now employed.

1045. Were they not intended to run the passenger traffic of the express trains? I have never seen anything to justify that limitation.

1046. *Mr. Hoyle.*] I shall put in a paper to show that they were.

1047. *President.*] What paper? The *Sydney Morning Herald*.

1048. *Mr. Eddy.*] What does it matter what is in a newspaper regarding these engines?

1049. *President.*] If the Railway Commissioners had said that they had brought such engines here for a certain purpose, and you could prove that they were not being used for that purpose it would be to the point; but how can it matter what appears in a daily newspaper in regard to them? All sorts of things are found in newspapers.

1050. *Mr. Hoyle.*] I intend to put in the *Sydney Morning Herald*, and to call the reporter to say where he got his information from.

1051. *President.*] Of course the *Sydney Morning Herald* is a very good paper indeed. We all know that; but if you get a reporter or anybody else to say that any one of the Commissioners said that the Baldwin engines were brought here to do certain work, and you are also able to prove that it was subsequently found they could not do the work, then that would be valuable evidence. But the mere fact that you get these statements from a newspaper has nothing to do with the case. Where you get your facts from is a matter of detail, and concerns no one but yourself. If you get them from the newspaper then you naturally look for the person who supplied that information to the newspaper, and the evidence of that person alone shall have any bearing upon the case.

1052. *Mr. Hoyle, to witness.*] Well do you know what these Baldwin passenger engines were brought here for? To run both passenger and goods trains; passenger trains in one direction and goods trains in the other, if required.

1053. I am speaking of the American passenger engines? Yes; and I am referring to the English as well as the American passenger engines. They were to be powerful enough to be useful for both goods and passenger work.

1054. Were they put on the northern and southern express trains, and if so, have they been taken off? They were; and taken off when their axles began to break.

1055. Have they been put on the express trains since the axles were replaced? No; we have now other engines equally powerful that are doing that work.

1056. Were those particular engines in the country when the Baldwin passenger engines had to be taken off this particular service? They were not.

1057. Then were there engines in the service powerful enough to haul these particular express trains? No; only when we put two of them together.

1058. After the Baldwin passenger engines were taken off the northern express, what engines were put on to do that work, that is before the last engines you referred to came to the Colony? Sometimes one class sometimes another—sometimes 304 class, sometimes 255 class. That train is a very light train, comparatively speaking, and almost any of our express engines in the service before the introduction of the Baldwin or English express engine could manage that train, as far as from here to Newcastle is concerned, and on some of the other sections. When the train was unusually heavy two engines had to be employed.

1059. Do you know of any cases in which two engines have to be employed when the 304 class engines were doing the work?

1060. *President.*] Is this to show that it was unnecessary to get the Baldwin engines.

1061. *Mr. Hoyle.*] It is to show that the Baldwin engines are unsuitable for the work.

1062. *President.*] Well why do you not ask him straight out, he is a gentleman upon whose integrity you will not cast any slur.

1063. *Mr. Hoyle.*] Certainly not.

1064. *President.*] Then why not ask him whether these Baldwin engines were disused from the express, because other engines were more suitable?

1065. *Mr. Hoyle.*] I understand that Mr. Thow has already said that they were withdrawn on account of the axles breaking.

1066. *President.*] And since the new axles were put in, have you got sufficient to go on that line? Yes.

1067. Why have the Baldwin engines not been put on again? They were put on some of the sections.

1068. *Professor Warren.*] What is the maximum speed at which you consider the Baldwin passenger engines should run? We have frequently run them up to 50 miles an hour.

1069. You consider them safe at that? We have proved it, by running them at 50 miles an hour.

1070. But you broke axles? We have run them at that speed since.

1071. And the Consolidation engines? They are meant for slow traffic. What I think Mr. Hoyle wanted to show was that another engine classed as the 304 class, was as useful as the American Baldwin engines.

1072. *Mr. Hoyle.*] Do you know whether these Baldwin passenger engines slip very much on our grades? No; I do not think they do slip very much.

1073. Have you any instances of slipping ever been reported to you? Only once, in Otford tunnel, and that was in very bad weather when any engine would slip.

1074. Was it an extra heavy train? No.

1075. You have heard of no slipping since? Oh, no; I am sure that the engines are well proportioned and would not slip more than they should do.

1076. Was that a wet day? It was one of those moist days when engines are likely to slip in tunnels. That was the only occasion that I remember upon which one of those engines have seriously slipped, but all engines will slip when the rails are damp, and it is quite a proper thing for an engine to do. I never think that there is anything wrong in an engine slipping a little, unless it is slipping too much.

1077. *Professor Warren.*] You do not consider that the cylinder power is too great in comparison to the adhesion? No; the parts are well proportioned.

1078. *President.*] You say that when the engines came into the country they were defective as far as the axles were concerned? Yes.

1079. Are they now defective? Do you mean the axles?

1080. I mean the whole locomotive? I do not think so at all.

1081. Are they unsuitable to the permanent-way of the Colony? Not to my knowledge.

1082. Are they not rendering that service which was expected of them? I think they are.

1083. And you do not think that the amount of repairs necessary in consequence of the manner in which the engines were constructed will be abnormally large? They will be higher than the repairs to English engines would be, but that will be the case with regard to all American engines. The maintenance of American engines is always higher, and that is the only distinction that I could draw between the two classes as far as efficiency goes.

1084. You evidently prefer English engines? Oh, certainly I do.

1085. *Mr. Hoyle.*] Is any of that bad material, or the same class of material that broke when the train was running into Sydney, in any of the axles in engines running now? Certainly not in the bogie axles.

1086. But in the tenders? It may be in the tenders, but the strains on the tender axles are not so great, and we have not found that they are giving the same trouble that the bogie axles did. The reason that we are removing the tender axles is a different one altogether.

1087. *President.*] Let me understand, what you found out was that the defective axles grew so very hot? Yes.

1088. And you found that the reason for that was that foreign material was enclosed which ought not to have been in the iron? Yes; that was what I thought.

1089. You have not found the same amount of heating with the tender axles? No.

1090. *Professor Warren.*] Nor in the driving axles? No; they are unusually large.

1091. And of iron? Yes.

1092. No driving axle has broken? No.

1093. And until it does, you will not know what material is in it? No; I should not think it would be a proper thing to pull those axles to pieces for the purpose of finding that out.

1094. *Mr. Hoyle.*] Who is the responsible locomotive officer in the Newcastle shops—who was there when the new Baldwin engines came in? Mr. Pilford.

Mr.
W. Thow.
14 April, 1892.

WEDNESDAY, 20 APRIL, 1892.

[The Commission met at 2 o'clock, in the Board Room, Colonial Secretary's Office.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

ALEXANDER BROWN, Esq., J.P.

W. M. Fehon, Esq.
20 April, 1892.

1095. *Mr. Brown.*] Mr. Fehon, you are one of the Railway Commissioners present I believe, you may remember that at the commencement of this inquiry I asked through the President that the whole of the correspondence in the possession of the Railway Commissioners in connection with the Baldwin engines should be produced in order that we might have an opportunity of perusing copies of it, and I presume that this correspondence has been supplied to us; but all that I have in my possession are copies of correspondence dating from 1st September, 1890, to 29th December, of the same year. This, I understand, is the correspondence which has been supplied by the Department. Now, what I wanted was the whole of the correspondence in the possession of the Railway Commissioners in connection with these engines, including the correspondence between those gentlemen and Messrs. Towns and the Baldwin Company, &c., both to and fro.

1096. *Mr. Fehon.*] The correspondence includes letters passing between the Railway Commissioners and Messrs. Towns & Co. with respect to the purchase.

1097. *Mr. Brown.*] But there must be some further correspondence in connection with the purchase of the Baldwin engines, and the business with respect to it. All the correspondence I have is between September and December of 1890.

1098. *Mr. Fehon.*] There is one letter we have received within the past ten days.

1099. *Mr. Brown.*] I wish you to give me the whole of the correspondence up to the last letter, including that between Towns & Co. and the Commissioners, the Baldwin Company and the Commissioners, and any others in connection with these engines.

Henry Bryant Howe being sworn, said: I am General Works Manager in the Railway workshops at Eveleigh.

Mr. H. B. Howe.
20 April, 1892.

1100. *President.*] How long have you been in the Service? I have been about twenty-eight years in the service of the New South Wales Railway.

1101. *Mr. Hoyle.*] We understand that you, in connection with others, recommended the importation of the Baldwin engines? I did.

1102. Had you anything to do with the drawing up of the amended specifications in connection with these engines. Were you consulted about the amended specifications submitted to the Baldwin Company? I was present at one meeting with regard to drawing up the specifications having reference to these engines.

1103. Do you know exactly all the alterations that were made in the original specifications? I could not say.

1104. When the engines arrived in the Colony were you supplied with a copy of those amended specifications? I was not.

1105. Did you minutely examine all the parts of the engines when they were being put together—did you consider it any part of your duty to see that these amended specifications had been carried out so far as materials were concerned? Well, it is a peculiar way to put the question, but I was not supplied with a copy of the specifications referred to neither did I consider it necessary.

1106. And therefore you could not, in erecting these engines, ascertain whether they had been made in conformity with these specifications?

1107. *President.*] In other words did you compare the engine and the specifications? I did not compare the work with the specification.

1108. *Mr. Hoyle.*] Then do we understand that your work as Works Manager was simply to put a machine together when it had been ordered by the Department, after the engine was ordered, and when it arrived you had to see that it was put properly together? That was my duty, I had to erect the engines.

1109. Did you receive no instructions when the engines came back to minutely examine the parts of the engines. Had you no instructions from the Commissioners or any other officers to make a minute examination of the different parts of the engines? I had not.

1110. Did you examine them closely? I did.

1111. Did you find any defect in them? Not any material defects.

1112. But in any of the parts? You talk about parts—I do not know what parts you refer to.

1113. Did you make any examination of the axles, such an examination as any man would make if he were going to properly erect them; did you examine the journals, boxes, see if they were properly fitted, and the boxes properly placed to the engine? Anyone who understood his business would know that would be the proper course to take.

1114. Were you satisfied that all the materials were good? Perfectly satisfied.

1115. Did you examine the wheels, and did you find any defects in them? No, none whatever, there were however some imaginary defects.

1116. Would you consider it a defect to be able to put any part of a knife into any part of the rim of the wheel? It depended upon what part it would be so far as the rim is concerned.

1117. Yes, the outer rim, the outer part of the rim immediately near the tire? What part?

1118. Between the spokes and the tire—suppose that any part of that portion of the rim, near the spokes were so open that I could put a knife into the hole, would not that be a defect in the wheel? I suppose it would not be as it ought to be if such were the case.

1119. But would it not be a defect. If you specify anything then you expect to get it sound, and have every thing of the best quality? Yes; of the best quality.

1120. Then if I could put a knife into any part of the rim, would not that be a defect? The question is to much qualified, if the rim were broken through, that is to say, if there were cracks through it, that would be a defect, but it would not be dangerous to the working of the engine, the tire would keep that together, and as to cracks in the wheels I should say that there are perhaps hundreds in the same way.

1121.

1121. Have those engines been very costly since they came here through having many repairs made to them? I could not say that they have been any more costly than other engines, I have not made any comparison that would lead me to believe that they were any more costly since they have been here than other engines.

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1122. *Professor Warren.*] Do other engines require their axles to be renewed to the same extent as these have required renewing? They have been more costly in that respect, but the makers have borne that cost.

1123. Have they not cut into the axles? The bosses of the wheels have cut into the face of the axle-boxes. 1124. Have you done anything to repair that? Yes, I have, by taking the wheels out of the engine and recessing the flanges of axle-boxes, and fitting brass liners.

1125. Do you consider that the future maintenance of these engines will be excessive, that is to say, more than ordinary engines, more, say, than English made engines? I think rather that the maintenance will be more.

1126. *President.*] Putting aside these axles, which we know now were bad, or some at all events of them, putting these aside, I say, is the expense of keeping the engines in repair, &c., greater than that of keeping ordinary new engines in repair? Of course, having to lift the engines on account of the bosses cutting into the axle-boxes has been an additional expense, these are cast-iron axle-boxes, the English engines have wrought-iron axle-boxes case-hardened.

1127. Would these engines then be much more expensive, from a point of maintenance? I cannot say much more expensive, for such things do happen to other engines as well. I could show you other engines which have had the wheel boss recessed and liners put in, it is not infrequent.

1128. But compared with the general run of new engines? Well, I am not prepared to say, perhaps the engines have been dealt with somewhat sooner than English engines, but still the same thing takes place with regard to English engines sometimes, but not to such an extent perhaps. That, perhaps, is accounted for by making the one with cast-iron axle-boxes and the other with wrought-iron axle-boxes case-hardened.

1129. *Mr. Hoyle.*] Have you had to take the wheels off any of these engines and put them in a lathe, either the bogies, tenders, or engines themselves? Yes.

1130. Will you explain why this was done? I cannot give the number of the engine. It was on account of the driver of the engine allowing it to skid, and this wore a flat face on the wheel, and because the wheels could not revolve, being locked by the brake.

1131. *President.*] Putting it out of the circle is what it comes to? Yes.

1132. *Mr. Hoyle.*] Was it caused through a failure of the brake-gear, or the carelessness of the driver? I am not in a position to speak with any certainty, and cannot say any more than that the face was worn down. It was done, to the best of my belief, from the fault of the driver.

1133. *Mr. Brown.*] Is that the only case of an engine being turned up, and the wheels put in the lathe? That is so, so far as our shops are concerned.

1134. *Mr. Hoyle.*] You know that the bogie axles or some of them have broken—one broke coming into the Sydney yard? Yes.

1135. And you know that new axles have been put into them? Yes.

1136. Can you tell the Commission whether any of the inferior iron removed on account of the breakage from some of the axles is still in any of the axles of the tenders? Inferior iron?

1137. Well, Mr. Thow described it in his evidence as iron of the most inferior description;—is any of the iron that came here originally in the axles still allowed to remain in the axles of any of these engines? Some of the original axles are still in the tenders, and from the latest reports in examination are running all right. They have not been heated.

1138. The examination in this case would be the same as that before? Yes; an examination from outward appearance.

1139. When new bogie axles were put in, were any of the bogie-frames renewed? One had to be very extensively repaired through the breaking of the axle. The breaking of the axle had twisted the bogie frame. There were no new bogie-frames made.

1140. Have there been any other extensive repairs made to any of the bogie-frames? I am not quite clear, but I think there has been one or two others, but that would be the whole extent.

1141. Can you explain what the accident was that necessitated the repairing of the bogie-frame? I cannot say, but I think it was through one of the axles of the bogie breaking. In the Bathurst district they had a frame injured.

1142. Is it customary for the bogie-frames to have to undergo repair so soon after the engines have been received? If they undergo injuries through an accident—yes. I could show you one now that requires repairs on account of a collision.

1143. Do you know whether there has been any trouble with any of the piston-heads? One has come under my notice; I put new piston rings into it.

1144. For how long was that engine running? I do not know.

1145. You know how long these engines have been here? Yes, they passed through my hands, and then went under the control of the out-door superintendent.

1146. What is the thickness of the tube-plate in the smoke-box—have you ever measured it? Well, I am not quite clear, but I think it is five-eighths.

1147. What is the customary thickness for boilers of that kind carrying this pressure? For an English engine boiler it would be $\frac{3}{4}$, but that is an answer that wants qualifying. The American system is to use much lighter plates in their boilers than it is customary to use in English boilers. There are thousands of American engines working with much lighter tube-plates. It is not because they are made of steel, for many of them are iron. They carry a pressure of 135 lb. to the square inch, but the general system in America is to use lighter material in their boilers, especially in the tube boilers than it is customary for English manufacturers to use.

1148. Do you know why these passenger engines were brought here;—was it to run the express service? I do not know.

1149. It would not come into your Department, a matter of that kind? No.

1150. Can you tell us whether stronger draw-hooks have been made since the engines came here? Yes.

1151. Have there been many failures of these hooks? Which do you allude to, the stronger ones or the former ones?

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1152. Those put on instead of those which were taken off;—have many of these broken? None that I know of.
1153. Would they give you notice if there had been any of these broken? Notice would be given either to me or to the District Foreman. Of course, they would apply to me for any hooks.
1154. How many sets of hooks have you made? I have made sixty-four—two to each engine, one for the tender end, and one to the leading end; these were charged to the Baldwin Company.
1155. Have any since been made? Not that I am aware of.
1156. Can you tell the Commission whether you had any trouble with the reversing-gear;—would that come under your Department? So far as the shops are concerned, there has been some little trouble with it; we have had to make some slight modifications.
1157. What was the matter with the reversing-gear supplied to these engines;—what was the defect in that gear? The defect was the fulcrum-point in the centre of the lever being light at the screw end, and that has been replaced by a pin through the bracket.
1158. Has that been done to all? Yes; not that they failed, but the one or two that did fail were taken as a criterion, and the rest were altered as a protection.
1159. If the reversing gear failed, was not that likely to cause trouble; suppose an engine had to pull up at a station, and could not do so through some defect in the reversing gear, might not that cause some trouble? It might cause trouble to an engine-driver who had not got his wits about him.
1160. Do you know anything about a Baldwin engine engaged in the morning of last Anniversary Day having an accident? I do not know.
1161. That would not be in your department? No; I do not know of it.
1162. *Professor Warren.*] We have asked for a list of repairs and breakages to these engines from the Railway Commissioners, and if I had that list with me now it might save us some time, but the Commission has not received it, and I am afraid we shall have to call Mr. Howe again.
1163. *Mr. Fehon.*] The list is not yet ready, I understand.
1164. *President.*] This reversing gear, Mr. Howe, is not a very material thing—a material part of the engine? Yes; it is a material part of the engine, on account of the handling of the engine, being used when it is desired to reverse the running of the engine; as, for example, when running tender first. It is merely a long screw attached to a rod leading from the reversing shaft, and is used to reverse the engine to send it backwards or forwards as may be desired.
1165. That, gear, I understand you to say, had given some trouble? It has caused no accident or trouble to any train, but a weakness has been shown in this gear, in the bolt or stud that goes through the reversing lever, that has been found to be light at the point. It has evidently been used by the American people made in this way, and they must apparently have found that in their case it gave no trouble, since they were working similar engines with similar gear to this in that country; and I presume that had there been any serious trouble with this gear in America they would have altered it.
1166. You have altered that gear here? Yes; in the shops.
1167. Was that a very expensive job? Oh, no; only an alteration entailing an expenditure of a few shillings.
1168. It is merely a question, then, of thicker material? No; a stronger fulcrum pin for the lever to work upon.
1169. Was that all? Yes.
1170. Was there no other trouble but that of the fulcrum pin? No.
1171. How many engines did this occur in? There were two of these points broken, and it was thought advisable, in order to prevent any trouble arising from others, that we should take the bolt out of all of them and put stronger pins in and rivet them.
1172. That is a small matter? Yes.
1173. And supposing they used lighter material and lighter fulcrum pins in America, would the sort of thing you have described naturally take place? Yes, it would, I think; it would happen in America, too, I think, if they ran the engines as hard there as we do here.
1174. Do you know if they ran any of these engines in America—I mean the engines which you have now got on the lines? Yes; I believe they did run one a fortnight before it came here.
1175. Had it the same amount of work to do there that it has to do here? No; the gradients, I believe were not the same, so the Baldwin Engine Company representative, Mr. Rhodes told me, but I do not know otherwise.
1176. Some of our curves are very severe, I hear? Yes; the 1 in 30 is very severe.
1177. Do you know any gradients where these engines had been running in America as severe as ours? No; I do not know.
1178. Well, would that account for the reversing gear being sufficient in America, and lasting there, and not being sufficient or lasting here? There is very heavy pulling, and a very heavy strain on this point, and it might give way under the work done on our lines, such might be the case.
1179. Is there anything to show that the American people knew of the sort of service that was expected of these engines here, that they were to pull loads on these steep gradients?
1180. *Mr. Brown.*] Yes, that is all in the correspondence.
1181. *Mr. Hoyle.*] Are you not now making a new set of reversing gear as an experiment to these engines? I have made a set, not entirely new, but with some alterations.
1182. If that new gear were carried out, what would it cost to equip each engine with it? I do not know, but the information can easily be obtained.
1183. What would be the approximate cost, if this new or altered gear were put on the engines? Do you mean each set; if we were to supply the whole of the engines, the cost per engine would be cheaper than if we made one or two singly; I should say the cost would be £15 to £20 approximately each, if we did the lot, and a man would take two or three days making each set, if they were turned out separately; but it would be cheaper if we were making a number.
1184. *Professor Warren.*] A good deal has been said about the broken axle, did any of the axles break in these engines when they were travelling at a good speed? Not that I am aware of; one broke at Sydney when the train was going at the rate of 2 or 3 miles an hour coming into the station, and in another case it was found that the axle-boxes were hot; this was at Yass or Junee.
1185. *Professor Warren.*] Where they all going at a slow speed? Yes; there was no actual danger at the time they were travelling.

1186. You consider that fortunate? I do.

1187. Supposing the train had been going at 30 miles an hour, and the front bogie axle broke, what do you think would have been the effect?

1188. *Mr. Fehon.*] I would like to call your attention to the fact, Mr. President, that Mr. Howe is a purely mechanical man, and knows nothing about the running of the trains and its effect upon the axles.

1189. *Professor Warren.*] I know Mr. Howe's position, and I am confident of his ability to answer the question I have put to him.

1190. *Witness.*] It depends upon circumstances. Sometimes a simple accident produces very serious results. Had the axle broken on the inside of the journal it might have remained there and not have come out; and even if it had come out and allowed the bogie to drag in front, the other pair of wheels would have kept the engine up, and there would have been no serious accident that I can see.

1191. Do you consider that it might have been a very serious thing to occur whilst the train was running at its ordinary pace? Yes; so far as the carriage axles are concerned it would be serious.

1192. But not so with an engine axle? No; a passenger axle may break and no alarm be given to the driver, unless a passenger happen to see it and try to communicate with him; but when the driver is on the foot-plate and an axle of his engine breaks he knows it instantly. I have known of engine axles breaking and drivers stopping their engines within a few feet.

1193. Supposing an engine was coming down a grade of 1 in 30, would not the breaking of one of its axles be a dangerous thing, and might it not cause a loss of life and property? Yes; of course such things have caused accidents, but you must know that the percentage of broken axles is very small, especially in the colonies, compared with the number of broken axles on the English railways.

1194. *Mr. Brown.*] But I suppose the distance run here is also comparatively small?

1195. *Professor Warren.*] But the percentage on the Baldwin engines, is not that very large? Well, that must not be considered in the statement I have made, at least so far as the bogie axles are concerned.

1196. *Mr. Brown.*] You say you were present when these specifications were amended, do you know what engine you had before you at the time you were considering this matter? It was not an engine in the Colony, it was a Baldwin passenger engine, similar to one now running in America, that is the one we had before us; there were modifications made in that engine, as for example to the diameter of the wheels.

1197. *President.*] Why were these modifications made? To suit the work upon our railway lines; the engine from which these specifications were originally taken had I think a 6-foot six wheel, or at all events a 6-foot wheel, and we reduced the diameter of the wheel to 5 feet.

1198. Were you satisfied with amended specification of the engine, that the amended specification would give the satisfactory result as the engine before you? I was quite satisfied that the engine when amended according to the specification would give the same satisfactory results.

1199. *Mr. Brown.*] As good results you say as the one before you? Quite.

1200. Were the alterations material? They were chiefly in revising the diameter of the wheels, and specifying for copper fire-boxes and brass tubes.

1201. Have you heard from the manufacturers themselves that they were dissatisfied with your specification as amended? I have not heard. I do not know anything about the correspondence.

1202. Would you be surprised to hear that they were dissatisfied? Yes; I do not know why they were dissatisfied.

1203. But if they themselves expressed an opinion that the engines would not under the amended specification give satisfaction to the Government, would not that surprise you;—I will read you an extract from a letter addressed from the Baldwin Locomotive Works, Burnham, Berry, Williams & Co., Philadelphia, 10th October, 1890, and addressed to Messrs. R. Towns & Company, in which it is said, "The proposed reduction of weight per axle will we fear, cause disappointment in the performance of the engine. We judge the same work is expected of them as that stated in the *Railroad Gazette*, as being performed by the Baltimore and Ohio engines, it should be fully understood that their efficiency will be correspondingly reduced." Are you quite prepared to learn that the manufacturers have made that statement? Well, from an engineering point of view they were reducing the weight on the wheels, and they may have wished to have supplied a heavier engine.

1204. Could you have used an engine of the character you then had before you without making these amendments? No.

1205. And if the locomotive manufacturers told you that they considered your road sufficiently satisfactory, and that you should have an engine exactly like the one before you, would you be surprised to hear it; would you be surprised to hear that they said that the engine you had before you was sufficient for the roads in this Colony; well, I shall read you another extract from this letter,—“As we understand that the permanent ways of the New South Wales railways are of a much more substantial character than the Baltimore and Ohio railroads, we see no reason why the engines built for the latter could not be adopted entire; we should be gratified if on further consideration this is decided upon.” Now, from this you will see that the manufacturers have sent you the specifications for a Baltimore and Ohio railway engine, and that they consider that that class of engine would have given satisfaction in this Colony, and protesting against the sort of modified engine you proposed, can you give any explanation with regard to this matter? No; I cannot.

1206. *President.*] Is this with regard to the weight of rail only,—you know our rails and viaducts; would not one of the Baldwin engines placed before you as a model at the time referred to have suited those viaducts and bridges? I am not clear as to the weight of these engines, the correspondence is new to me, and it takes me somewhat at a disadvantage, I have never read it.

1207. *Mr. Brown.* Did you say Dr. Williams, of the Baldwin Engine Company; would be able to give them every information with regard to this Colony? Yes.

1208. And if they are writing from his information they know something about the matter? Yes.

1209. In fact, they are perfectly seized of the matter? As to bridges, I am not quite sure.

1210. But they wrote that with some reasonable intelligence, having some knowledge of the matter? Yes; since he has been here on two occasions to my own knowledge.

1211. *Professor Warren.*] I assume that the following information will be supplied to us; and, in now asking for it, I do so thinking that considerable time will be saved; if the engineer were here himself, it is very unlikely he could give the information I require without a reference to data and calculations, and, therefore, I ask it to be furnished to us in the form of a return as follows:—A tabulated statement of the bridges built since the Railway Commissioners took office, giving the following particulars:—1. Position of bridge.

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bridge. 2. Number of spans, and length of each. 3. Whether a deck or through-bridge. 4. Materials used in superstructure and piers. 5. Spacing of cross-girders and longitudinals, where they exist. 6. Actual intensity of working stresses in the main and cross-girders when loaded with Baldwin engines. 7. Live loads for which the bridges were designed, per foot run. 8. Whether any tests have been made, if so the maximum deflection obtained, and the weights on the wheels of engines, and tenders used in testing. 9. What methods have been adopted, or are proposed, for the strengthening of Penrith bridge. The bridges over the Wollondilly River, and the bridges over the Solitary Creek, in order that they may not be over-stressed with the Baldwin engines. These are very important questions, and will require some consideration.

1213. *Mr. Fehon.*] Many of the bridges you speak of were constructed by the old Construction Department, and the Railway Commissioners took them over. The only ones the Commissioners have erected are those in connection with the duplication and quadruplication of the lines lately. The other information will have to be furnished by the Construction Department.

1214. *Professor Warren.*] The reason I ask particularly for the bridges constructed since the Commission came into office, is because the Royal Commission on railway bridges goes into the matter of the railways built by Mr. Whitton, very extensively; that is why I carefully avoided any reference to them. I only ask for the bridges that have been built since the present Commission took office. Question 9 is based upon what is actually known of the Penrith, Wollondilly, and Solitary Creek bridges. In addition to that, Mr. Thow gave, in evidence last week, certain statements with reference to the appointment of an Inspector, to the effect that certain correspondence had passed between the Commissioners and Mr. Thow, whilst that gentleman was in America, and I would like the Commissioners to furnish us with a copy of that letter.

1215. *President.*] Can you say now, Mr. Howe, in looking at these axles, what was the cause of their breaking—did you find out the cause when they did break? "What," you ask, "is the cause of their breaking?" Well, through running hot, and, of course, through being made of bad material.

1216. Would a bad material make them run hot? It would tend to make them run hot.

1217. On account of foreign matter contained in the bad material? Yes, on account of the slag or dirt, if they were showing any seams that would work out. The bad material tends, of course, to make them hot; but even the best of axles will run hot.

1218. Even if there is proper provision made for oiling them? Yes, even then.

1219. *Professor Warren.*] And with sufficient bearing surface? Yes, at times an axle will start to run hot, and cause a deal of trouble, and afterwards cool down and run alright.

1220. *President.*] Why is that so? There is hardly any accounting for it at times.

1221. But perhaps that would be because the oil would not be kept well over it? That would not interfere, you may pour as much oil as you like on it, and that would not prevent it running hot. The presence of any foreign matter would cut the axle and would cause it to become hot.

1222. And would not allow the oil to get properly on to it perhaps? Oh that would not matter; it would get heated to such an extent that perhaps the oil would be set on fire and flame up. I have seen a flame of 2 or 3 feet high bursting out from an axle box that had become heated.

1223. *Professor Warren.*] How do you account for the axles turning out so badly when the specifications had been made out? I cannot say why, the axles I believe are not made by the firm, that is the Baldwin Company, but by an outside firm, and the makers of the engine have themselves admitted they have been taken in through this bad material.

1224. Do you know the English system? Yes.

1225. If locomotives were ordered from England, would it not be stated that the axles should be submitted to the tensile ductility, and probably the drop test? Yes.

1226. Would this have happened if a similar system had been adopted with regard to the Baldwin Company? In all probability they did not adopt that system. No American system that I know of use any such tests; in fact, as a rule, there are very few inspectors on the job.

1227. Would the absence of these tests induce bad axles? Certainly they would tend to.

1228. There would be no means of telling if they were good or bad? Not until they commenced to show the signs themselves. It is not usual to take a pair of wheels off axles and destroy it in order to ascertain if it is bad. If we found flaws in it, of course, we would take it out.

1229. But if some of the axles had been tested that would have given an idea of the quality of the material contained in them? Yes.

1230. *President.*] In England, you say, they apply these tests? Yes. In America they do not.

1231. Then what guarantee have you got that these engines are sound? Well, you must depend upon the names and reputations of the manufacturers. The Baldwin Company bears an excellent name for engines.

1232. But if they get their axles from other people then they have to rely upon the honesty of other people? Yes; or take the responsibility.

1233. Well, I do not know about the responsibility. If you have a whole train of people killed, it is just such a case as where a man lives on his reputation. It is very unpleasant if any blot be cast upon it, but what remedy is there for the unfortunate people who suffer? The firm, in justice to themselves, should, in ordering these axles, have specified a test to be given to them.

1234. *Professor Warren.*] Much more so should a proper specification have been written out here. If it is necessary for the Baldwin Company to secure good material to stand the tests, surely the same system should be adopted by us with regard to the American engines we purchase.

1235. *Mr. Hoyle.*] I submit that human life should be regarded of more account than the honor and reputation of a firm of locomotive manufacturers.

1236. *President.*] Yes, I think so, you need not argue that before me.

1237. *Mr. Brown.*] There are some matters referred to in the correspondence of which I have copies. There is a cablegram from the Commissioners to the Baldwin Engine Company saying "Reduce weight to 32,500 lb. per axle, by reducing grate area, allowance expected for reduced weight; screw hand-brake on tender and drivers, Westinghouse air on drivers and tender; width over all 9 ft. 3 in. in offer, includes an engineer, must supervise erection and trial." In reply to that cablegram the Baldwin Engine Company confirmed the first part, and goes on to say, "An engineer must supervise erection trial." What will they mean by that? Does it mean that the Company expected you to supervise, or that they would do so?

1238. *Mr. Fehon.*] They sent a man out from their works to supervise the erection of the engine here.

1239. *Mr. Brown.*] Then that is what is meant? Yes.

1240. I suppose that man did come and put them to a trial? Yes; I believe it was the same man who supervised the erection of the Baldwin engines here some years ago. I believe this gentleman was the same as the one I referred to.

1241. *Mr. Fehon.*] His name was Mr. Rhodes, and he will be in Sydney next week, when he will be called to give evidence before you.

1242. *President.*] In a letter which Mr. Fehon has just given me, received from the Baldwin Company, and dated 15th February of the present year, it is stated:—"In contracting for these locomotives the Commissioners desired to obtain engines adapted to unusually heavy service. In order to secure the utmost efficiency, and to obtain the best results of American experience, they left many of the details of the specification to our judgment. The material for the driving, truck, and tender axles was left optional, and as, in our opinion, the most satisfactory results are usually obtained from axles carefully forged from selected scrap-iron. We ordered such axles from the manufacturer whose product we had been largely using with good results, and whose reputation for excellent work is generally recognised. No test was prescribed by us, as it is well known that no test of scrap-axles is conclusive. We relied upon their showing clean, uniform, well worked material when turned up in the lathe. Steel axles, or axles forged from muck-bars, can be tested under a drop with reasonable probability of the uniformity of the axles not tested, but the fact that a hammered scrap-axle withstands such test is no guarantee that others of similar manufacture and appearance will stand. Not only have we been buying axles in this way for many years, but so far as we know, it is the general practice in buying hammered scrap-axles, both by railroads and manufacturers. These axle-forgings did turn up clean, smooth and free from flaws, and we supposed them to be as good as the many hundreds which we had received from the same maker without one instance of failure coming to our knowledge. We go into the matter at this length to assure you that there was no conscious lack of diligence exercised by us to supply materials of the best quality, which your Government was entitled to receive from us. We have already replaced the twenty-four engine truck axles with others of steel. We offer to reimburse the Government the cost of replacing the forty-eight tender axles. We also offer to pay the reasonable cost of the labour involved in effecting the replacement. We are of the opinion that the original dimensions of the truck and tender axles and journal bearings are ample for the fast speed for which the locomotives are suitable, provided the quality of the material is good, and the bearings are well lubricated. These dimensions are here considered the best for such engines, and have been widely adopted for similar service with good results. We should have much hesitation in increasing the diameter of the bearings with such small wheels, owing to the higher rotative friction. It should be borne in mind that the smaller truck wheels necessary in engines of this type require closer attention to the lubrication than the larger wheels usual in English locomotives. If, however, larger bearings are adopted, we urge the desirability of making them $5\frac{1}{2}$ inches rather than 6 inches in diameter. In view of the above, we think the cost of new boxes, whether of iron or solid gun-metal, should not be charged to us, as we are certain that the replacing of the axles will prove a sufficient remedy. We remark that the driving axles were not made by the same party as the truck and tender axles. We therefore trust they will, upon investigation, prove satisfactory. There appears to have been a clerical error in transmitting to our shopmen the dimensions of draw-hooks shown by your drawings. We authorise you to debit our account the cost of replacing them with stronger hooks. With these modifications we trust the engines will speedily show the special adaptation, which we believe they possess, to the difficult service for which they were ordered. That similar engines are doing such work on our American railways is shown by the recent tests of our 10-wheel locomotives on the Baltimore and Ohio railroad. Under separate cover we mail you three copies of the report of these tests. We trust these tests will in a measure justify the wisdom of the Commissioners in the purchase of these locomotives, and that after the defective axles are replaced, the performance of the locomotives will be such as to merit their entire approval." Does the statement that there was no conscious lack of diligence exercised by the company to supply materials of the best quality arise from there being no means of testing the scrap-iron axles, though of course you could test it by the weight test I suppose? Yes, the drop test.

1243. But is it right to say that you cannot tell whether the material is good or bad if you have similar scrap-iron to that contained in the axles, could not the tests be applied to that, and would not that be a guide to the quality of the material? Two axles might be forged, one might be as good as another, or on the other hand might not be, that very much depends upon the qualifications of the men who worked them, an axle might appear to be good and sound outside, but perhaps would not be properly worked together or united, but would be reedy in the centre.

1244. Not properly welded together? Yes, quite so. It would perhaps have every appearance of being sound, and yet on going a little way into it it would be found to be reedy.

1245. Is there no way of testing axles but by breaking them;—could you not get weight enough to drop on them to ascertain if they were sound without necessarily breaking them? If once you apply any test it is not safe to use them afterwards. For example, the man who is turning the axle comes to a bad place where the iron is reedy; he would then throw that axle aside, and it would not be used. The usual way of testing these axles is this: So many axles are required, and order is given, say for 200, and we test, say 1 per cent., and if that percentage successfully withstands the drop test without tearing the material to pieces you take that as a test of the whole number.

1246. I am not quite clear as to the nature of these tests? I will explain. The tensile test is to reduce the material to a square inch and then tear it asunder; then there is the reduction into sectional areas, and the ductility test.

1247. Showing how long the material will draw out before it breaks? Yes.

1248. Then, according to this letter, supposing you did test one or two axles, still if they are made of scrap-iron that would be no proof of the soundness of the rest? It is not a proof, but it would be taken as such. The man working at each axle would probably make them all in the same way, so that most likely if the percentage were sound the rest would be found to be so.

1249. You are supposing that so much of the work should be subjected to a test, as well as trying portion of the iron from which the axles have been made? It is this way. A man forges a number of articles from the same heap of material, and you take one of these articles out of the number he has forged, and apply it to a test, and if the material in it should be successful under the test, then you would conclude that the remainder of the article was equally sound and good.

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- Mr. H. B. Howe. 1250. But you cannot tell if they are sound from an external examination? No.
- 20 April, 1892. 1251. *Mr. Brown.*] Is there not some place where these tests are regularly made—Kirkcaldy, I believe, is the name? Yes; they are always made there.
1252. *Professor Warren.*] Yes; there is a special man for making these tests in England—Kirkcaldy.
1253. *Mr. Brown.*] Yes, I know; I had some tested there myself.
1254. *Professor Warren.*] You could not have done better.
1255. *President.*] You found some of these axles broken, you say;—some of these have been ill-made, I understand, but as to the others, do they continue to remain in the engines? I do not see why they should be removed; nothing has happened to them since.
1256. Such, for example, as heating;—is that what put you on the guard? No; an axle might run hot, and in consequence of doing so it would have to be examined before it could be allowed to run again. It must be examined and refitted, and in going through that operation, if it were found that the journal were not fit to run again, the axle would have to be removed; but you might examine the axles, and to all outward appearances they will appear to be all right. I should not think of removing these axles at present.
1257. *Mr. Fehon.*] I think there is some misapprehension in this matter. I would like you, sir, to ask the witness if all the bogie axles have been removed.
1258. *President.*] Have all the bogie axles been removed? Yes, every one of them; I am referring to the tender axles now.
1259. *Professor Warren.*] Were not any tender axles broken? Yes; I think two were, one of them was twisted off in the journal at Newcastle, I think, but that is not an uncommon occurrence.
1260. *President.*] It does not show that the axles were inherently bad? No.
1261. Then I understand all the bogie axles have been removed? Yes.
1262. Now it seems that the bogie axles have been proved to be bad, and you have done something to other portions of the engine; now looking at these things, would you say that these engines are defective, and not doing their work? No, sir.
1263. Are they fit for the permanent-way of the Colony; fit and suitable to do the work they are doing every day, and the class of work they were ordered for? Yes; and I am not sure that they are not doing more than they were ordered to do, the goods engines especially.
1264. You say then that they are doing the work that was expected of them, and the passenger engines are they doing the service they were expected to perform, and for which they were ordered? Yes.
1265. *Professor Warren.*] Would you say, Mr. Howe, that the engines are suitable for the permanent-way of the Colony, provided that the bridges are strong enough to carry them; that is a separate matter? Yes.
1266. *President.*] You mean the permanent-way? Yes.
1267. They would not cause the rails to be crunched down—I do not know the technical term, that is what is meant? No.
1268. In permanent-way you do not include anything about the permanent bridges or viaducts? No; I do not enter upon that question.
1269. *Mr. Brown* (to Mr. Fehon.)] I see that a letter you have put in is part of the correspondence of the Baldwin Engine Company? Yes.
1270. If you had carried out my suggestion it would have been more convenient for us; I asked for the whole of the correspondence, and this letter, among others, would have been included, but instead of that you have supplied me with three months' correspondence instead of fifteen months; you have not done what I asked you to do? I do not know anything about it. The Secretary informs me that what you desired to have was the correspondence with regard to the ordering of the engines.
- 1270½. No; what I wanted was the whole of the correspondence in connection with these engines; will you let me have the rest of the correspondence? Yes.
1271. *Mr. Hoyle* (to witness.)] You say that the passenger engines are doing the work for which they were brought here? Yes.
1272. Then why did you put a goods Consolidation engine to take a train from Penrith to Katoomba? I do not know. The only information I can give is that instead of taking an assistant engine the work is now done by this one engine, and thereby a second engine is saved.
1273. If these engines were brought here to do this work why have you given them a second engine? I do not allude to the passenger engine. Undoubtedly there are times when the train would be too heavy even for a Consolidation engine to take.
1274. *President.*] You mean with an exceedingly heavy load? Well, sir, it is not in my department, and I might be giving you answers to your questions which might not be strictly true.
1275. *Mr. Hoyle.*] Are you positively sure that these axles were hammered iron; are you positively sure that they are not only bar-iron? I do not believe they are bar-iron. I believe them to be hammered scrap-iron.
1276. When the journals were turned on the axle was the piece or shoulder against which the wheel goes as large as the ordinary shoulder put into a English engine? English engines do not have shoulders, the end which comes into the wheel is larger than the journal of an English engine.
1277. Then how do you fasten them? They are put on by the hydraulic press, no wheels for rolling stock are now put on to a shoulder, this is one of the most effective ways of putting them on, there may be a mark for a man to press his wheel up to.
1278. Is there a swell there? There may be; I cannot say.
1279. There is a viaduct at Lewisham, and an axle broke on the train there, I believe? Yes; on a vehicle.
1280. Where the trucks and break-van attached to that train thrown down the embankment in consequence of that breakage? There were one or two carriages thrown down, I believe.
1281. And the broken axle was alleged to be the cause? Yes; but that was one of the axles to which you have just now alluded as having shoulders.
1282. When you were putting these engines together you were aware of course that the bogie wheel being half as large as the driving-wheel? Yes; one-half of the diameter.
1283. It would, of course, travel twice the speed of the other, that is to say, for every one revolution of the larger wheel there would be two revolutions of the smaller wheel? Yes.
1284. Did you observe whether there were oil-boxes or oil-caps attached to the engines for lubricating purposes? There were oil-boxes; a system adopted with regard to all American engines, the top of the boxes

boxes open and are filled with cotton-wool, and the wool on the top of the box forms a receptacle for the oil, and from it, the oil filter to the journal, this is a recognised American way of lubricating axles.

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1285. *President.*] Is there no cover? No cover.

1286. *Mr. Hoyle.*] Is the same oil provision now on the engines as was there when they first arrived in the Colony? No. They have a different system of oiling now; we have adopted the English system of oiling—out-side boxes.

1287. Are there any supplementary feeders to the boxes;—you have supplementary feeders for the leading and trailing wheels, have you not? You mean the oil-boxes supplying the journals with oil?

1288. Yes;—on the side of the boiler are there any such supplementary feeding-boxes for these engines? Yes; there are.

1289. Were there any on the engines when they first came here? No, not on the bogies.

1290. *Professor Warren.*] I am sorry that we should have to ask you again to give us the information I have already referred to; I think you know the details?

1291. *Mr. Fehon.*] The information you require will take some time to prepare; we must have time to prepare it in.

1292. *Mr. Brown.*] I think the information ought to be given to us by the Department.

1293. *Professor Warren.*] What I want is a list of all the breakages, the costs of renewals and repairs, you have made, and, as far as possible, the whole cost of the Baldwin engines since they have been here. If it would take a very long time to get the complete cost, we should have to be satisfied with a list of the breakages and renewals. I have prepared a list of what we require as follows:—

1294. *Mr. Fehon.*] You do not want the repairs minutely specified I suppose, they must be taken approximately, otherwise it would take quite a fortnight to search through the time-books, &c., one item might cost 2s. another 10s., and so on.

1295. *Professor Warren.*] I could estimate them approximately, but the repairs themselves are important;—what you allude to I understand are the workshop repairs? Yes; you do not want the running repairs, such as letting up a pair of brasses and small things like that.

1296. *Mr. Hoyle* (to witness).] You say that one of the axles of the tenders broke? Yes.

1297. Was the iron in that axle tested? Yes; it was.

1298. What kind of iron was it, bad or good? It was not the best of iron that I have seen, but I do not say it is as bad as the iron in the bogie axles was.

1299. But it is not really good iron? No; it is not really good iron.

1300. *Professor Warren.*] Do you think the material in the bogie axles good enough to be used anywhere in any engine? No, sir.

1301. Would you use it yourself if you were making axles? No; if I had applied the usual tensile test I would not have put the material into the axles.

1302. *President.*] Then again about the axle of the tender, you say that was not good iron? It was not the best iron.

1303. Was it iron such as should have been used for such a purpose? As far as I am concerned I do not know, if I were building the engines I would not use such material, but still at the same time there is nothing dangerous about these tender axles, they could not be any material danger to the tender.

1304. *Professor Warren.*] A broken axle in a tender would not mean the same thing from a point of danger as in a passenger carriage? Oh, no it would not be the same as if it were a passenger carriage.

1305. Axle material should be the finest and best material that can be produced, should it not? Yes.

1306. *President.*] Even for a tender? Yes, for everything.

1307. Did they use different iron for tender axles than for other parts of the engine? Yes, generally speaking their material in America is of the very best quality for other work, for boilers and other parts of the engine in which there is wrought iron it is especially good.

1308. Between the axles and the bogie and the tender do they make any difference? They might have been made by different processes, or different men may have made them.

1309. To make such a difference between the two classes of axles for the sake of economy would be cutting it very fine, eh? Yes, it would be cutting it fine.

1310. *Mr. Hoyle.*] Before you call the next witness I would ask you if you would order the Baldwin passenger engines Nos. 456 and 457 to be placed for the inspection of the Commission either at Sydney or at Penrith. I would like to have them placed for the personal inspection of the Commission and especially for the inspection of Professor Warren.

1311. *President.* (to Mr. Fehon).] Is it troublesome to bring them to Sydney because we can go to Penrith if it suits you better or we can see them in Sydney.

1312. *Mr. Fehon.*] We can bring them to Sydney just as easily.

1313. *Mr. Hoyle.*] I would like you to go to Penrith so that on your way you can see about these platforms being in gauge you would be able to ascertain the different measurements between the step of the carriage and each platform.

1314. *President.*] As they are altered now Mr. Hoyle? Yes.

1315. *President.*] What have we got to do with them? As I understand the scope of our inquiry, as I understand it is whether the Baldwin are defective and unsuitable to our permanent way seeing that these platforms had to be altered and chipped away just about the time the Baldwin engines were to arrive, do you therefore contend that the engines were unsuitable to the permanent way. Supposing these platforms had been altered and that new platforms had been built by the Railway Commissioners, and supposing for the sake of argument were of wrong gauge, what have we to do with that?

1316. *Mr. Hoyle.*] It has been sworn by more than one witness that these platforms were altered in order that the line shall be put in gauge, and I want to show that they are not in gauge now. They differ the one from the other.

1317. *President.*] But supposing there is now no danger of any of these verandahs scraping on the sides of the carriages, what then? Does not gauge mean that these platforms are exactly the same distance from each other, and out of gauge that there is a slight variation between them. In other words, do you say that they must be such a distance apart; and that if there is a little distance then they are out of gauge?

1318. *Mr. Hoyle.*] It has been sworn that alterations were made in order to put these platforms in gauge.
1319. *President.*] They say that the Baldwin engines had nothing whatever to do with it but that this action was taken simply to bring the platforms to gauge.
1320. *Mr. Hoyle.*] What I desire you to see and to measure on your trip to Penrith is that these platforms do not gauge alike.
1321. *Mr. Brown.*] And the Railway Commissioners have said that their object was to secure a uniformity of gauge, according to the Board of Trade Regulations. Do you want to show that they have not brought them into uniformity?
1322. *Mr. Hoyle.*] Yes.
1323. *Mr. Brown.*] I see what he wants. It is a question of the credibility of the witnesses.
1324. *President.*] I quite understand that. Have new platforms been built altogether?
1325. *Mr. Hoyle.*] Yes, there have been certain platforms built in connection with the quadruplication of the Southern line. And I want to show that since they have been altered, it has been sworn here that the alterations to the platforms were made in order to bring them up to the standard gauge, and that the Baldwin engines had nothing to do with it. I want you to see now that these platforms are not all alike, and it may have some influence with you when you come to review the whole of the evidence.
1326. *President.*] Suppose it was necessary to have a certain width between the platforms and the inside of the rail, and supposing that they have not got them to that exact dimension, will you inform us how does that affect the question?
1327. *Mr. Hoyle.*] I want you to measure the distance between the platform and the carriages.
1328. *Mr. Brown.*] It is a question of the credibility of the witnesses.
1329. *President.*] Quite so.
1330. *Professor Warren.*] Have any of these platforms been altered?
1331. *Mr. Hoyle.*] Yes, some of them have. I think you ought to insist upon having the information with regard to all the platforms that have been altered, and the distance they were before the alterations, also the distance they now are, and what is the proper gauge to which they ought to have been brought.
1332. *Professor Warren.*] The information was asked for.
1333. *President.*] Can some gentleman of the Department give us this information. It would appear to me to be a very rough way of measuring the distance.
1334. *Mr. Hoyle.*] I will put in writing to-morrow exactly what I want.
1335. *President.*] Of course we will go to Penrith as you wish it Mr. Hoyle. But do you want us to go to Penrith if the Railway Commissioners give us the informations that you ask for.
1336. *Mr. Hoyle.*] Yes.
1337. *Professor Warren.*] I propose to make a test of the Baldwin passenger and it is this:—The Baldwin passenger engine to be attached to a train consisting of fully loaded trucks and one brake-van, having a gross load exclusive of engine and tender of 144 tons, and to run this train from Sydney to Goulburn. During the trial, indicator diagrams will be taken at frequent intervals, and the quantity of coal and water consumed during the entire journey would be correctly ascertained. The speed attained would be ascertained by observations with ordinary stop watches, at the various mile posts throughout the journey. In climbing the long incline between Picton and Mittagong (1 in 30 or 176 feet per mile) a further test of the full capacity of the engine to haul heavy loads would be furnished, and the speed attained, taken in conjunction with the load hauled, would give data for calculating the maximum horse-power developed. The facts and figures properly tabulated would materially aid the Commission in their inquiry and would be of great value to the Department. But facts and figures are necessarily incomplete in this case without some standard of comparison, as the recorded performance of any of our engines on this road would furnish no useful data for comparison with engines of such a powerful type as that of the Baldwin engines. It is necessary to compare the performance of the Baldwin engines in such a test with an engine built by some other makers for the same class of service, and being at the same time of similar size and capacity. Such a comparison could be made by selecting one of the newly imported passenger engines, built by Messrs. Beyer & Peacock, of Manchester, as they are almost precisely similar in size, weight, and in other respects, to the Baldwin engines. I propose to subject both engines to the same test, with the same load on the same road, so that the conditions would be precisely similar, and the results obtained strictly comparable. We shall take indicated diagrams and we shall have the speed at which the engine is going, and the coal and water consumptions so that we have by this means an accurate test of coal, and water, and horse-power. The reason for going to Goulburn is this, that in taking a five hours trip we have the actual weight of coal, and the water we are therefore able to balance up equally. It would be necessary to have at least a five hours trip to make a satisfactory test. I will take charge of this test and carry it out, and get all the points that I want. (To Mr. Fehon): Will there be any difficulty in having one of the passenger engines? It is a simple matter.
1338. *President.*] What day will be most convenient? Mr. Fehon we should have to get one of the engines from the North-eastern line.
1339. *Professor Warren.*] There are three Baldwin engines. The passenger engine, the Consolidation engine, and the Compound engine. We are taking the Baldwin passenger engine; could we not arrange to have tests of the others?
1340. *Mr. Fehon.*] Mr. Stangar says that 144 tons would be rather an extreme load for the 1 in 30 up the Picton road.
1341. *Professor Warren.*] I picked that out in order to make it do its utmost.
1342. *Mr. Fehon.*] About 132 tons Mr. Stangar thinks would be a fair load to put on up the 1 in 30 gradient.
1343. *Professor Warren.*] They were ordered to do that, that is why I have stated it.
1344. *Mr. Brown.*] It was expected that they would do it, they were not guaranteed to do it.
1345. *Professor Warren.*] It does not matter, we could easily get the speed, it will only go a little faster, that is all.
1346. *Mr. Hoyle.*] I think the comparison ought to be made with the most powerful engines before these came, there are some that since have come out, Beyer and Peacock's engines, I would prefer that the test should be made with the most powerful engine before the Baldwin came out, I will suggest the Mogul engine.

1347. *Professor Warren.*] I would rather have them try the very ones you object to, as they are engines which are brought out to do practically the same work.

1348. *President.*] It is much better for you, I think; it is harder to try them against recently imported engines than one which was here when the Baldwin came.

1349. *Mr. Hoyle.*] Well, Mr. President, I would like to be understood that I have only taken up the position I do as a man in a public position. It has been asserted that these engines have been brought here to do the work of two engines before them, therefore, I do not think that 144 tons is excessive, I think you will find that the weight recommended by Mr. Neale as the standard weight should be adopted, he recommends a train of 296 tons goods and 220 tons passenger, including the engine, which will weigh about 80 tons.

1350. *Mr. Brown.*] They did not ask that the Baldwin engines should draw that weight, they said the required load would be 120 tons without the engine or tender.

1351. *Mr. Fehon.*] These grades are heavy and there are sharp curves.

1352. *Mr. Hoyle.*] I wish it to be borne in mind that these engines were brought here that one of them could do the work of two before.

1353. *Mr. Brown.*] The Railway Commissioners, when they imported these engines, spoke of a train of 120 tons; at present, therefore, we must be guided by what is before us in this correspondence.

1354. *Mr. Fehon.*] The engine does do the work of two engines, but it is not expected that she should draw the load of two engines.

1355. *Professor Warren.*] Would you kindly enable a test to be carried out between the Beyer and Peacock engine and one of the Baldwin engines. I know you intended to make this test because Mr. Eddy in his speech at the Railway Institute, said that the Department intended to test the Baldwin engines against the Beyer and Peacock. Now the Beyer and Peacock engines are almost the same as the Baldwin engines—there is about 2 tons difference; the weights on the driving wheel are almost precisely the same.

1356. *Mr. Fehon.*] We have no objection, but we can furnish returns showing what each class of engine has done up to its highest point, on each gradient. We can furnish that easily.

1357. *Professor Warren.*] It was stated that it could be given in a rough way, but the witness said in his evidence that at similar trials in South Australia he had taken indicated diagrams, but he had not taken indicated diagrams in this Colony. We should have several tests, and that would show that we are doing our work properly.

1358. *Mr. Fehon.*] We have only made ordinary every-day tests, and we have not taken these through necessity or for scientific purposes, but for commercial reasons, so that we may know what we may put safely behind an engine, so as to take it safely to its destination.

1359. *Mr. Brown.*] Would not that do you, Professor?

1360. *Professor Warren.*] The work will be heavy while it lasts, but it will fall upon me—these tests will be valuable, and they will be accurate.

1361. *President.*] Are they practicable?

1362. *Professor Warren.*] Oh, yes; I will answer for that.

1363. *President* (to Mr. Fehon).] Can they be carried out without disturbing the traffic?

1364. *Mr. Fehon.*] Yes; what about the Mogul engine?

1365. *Mr. Brown.*] I think a comparison should be made between the engines which we had in the Government service before the Baldwin engines came here.

1366. *Mr. Hoyle.*] The Mogul engines were brought out to do the express service, and they did it until the last engine from Beyer and Peacock arrived. Now, I should like a comparison to be made between the Mogul engines, if they are able to do this service, and the Baldwin engines, which, as a matter of fact, had to be taken off.

1367. *President.*] How many of these Mogul engines were here?

1368. *Mr. Fehon.*] Eight or ten.

1369. Were there enough for the service? Yes.

1370. *President.*] That will be a third day required.

1371. *Mr. Fehon.*] We will arrange for any day you like that will be convenient.

1372. *Professor Warren.*] The only thing necessary will be to fit up indicator-gear on the engines.

1373. *Mr. Fehon.*] We would like to know the extent of the tests you desire to make.

1374. *Professor Warren.*] Mr. Brown suggests the Mogul engine.

1375. *Mr. Brown.*] I think it would be well to make a test with the engines that were in the Government service and which were the best in their service at the time when the Baldwin engines were ordered.

1376. *Mr. Hoyle.*] I especially ask that the test may be made in regard to the Dubs' Mogul engine. It is an American engine, built by Dubs.

1377. *President.*] Professor Warren will look after that. What I want to get at is when it is we are going to make the tests. Owing to Mr. Brown's scruples, we cannot go on Sunday. Indeed, I think it quite right if we do not interfere with the traffic on other days that we should not go on Sunday, but that only leaves Saturday on which I can go.

1378. *Professor Warren.*] And that is a bad day for the traffic.

1379. *Mr. Brown.*] Can you make it Monday or Tuesday?

1380. *President.*] If you could make it next Monday it would suit me.

1381. *Mr. Robert Smith.*] Is it necessary for all the Commissioners to be present at the proposed test;—would it not be sufficient if Professor Warren was to go alone?

1382. *President.*] Well, so far as any practical knowledge that I may bring to bear upon the matter is concerned, it is quite unnecessary for me to go, and apart from that I have no particular desire to go; but to allow Professor Warren to go by himself seems like deserting a mate.

1383. *Mr. Hoyle.*] With all respect, Mr. President, I submit that the gentleman who put the last question to the Commission had no right of audience. Might I remind you that, being the legal adviser of the Commissioners, that gentleman comes under the rule that you laid down precluding the appearance of legal representatives before you.

1384. *President.*] It was merely as a matter of convenience to the Commissioners themselves, Mr. Hoyle, that Mr. Smith made the suggestion. It had no reference to any legal standing, and was merely a suggestion that might have come from any person in the room. In regard to this matter I will do anything that Professor Warren thinks best. If he thinks it better that he should go alone, then I shall not go; if he thinks it desirable for me to go, then I shall go.

1385.

1385. *Mr. Hoyle.*] Are we to understand that the Mogul engine will be included in the test?
 1386. *President.*] Yes, we will understand that Dubs' Mogul engine is to be put in the test.
 1387. *Professor Warren.*] As a third test.
 1388. *Mr. Fehon.*] Would you wish these engines all to run to Goulburn?
 1389. *Professor Warren.*] If we are to have an equal test of these engines, we shall have to run them on the same train.
 1390. *Mr. Fehon.*] Would it not be enough to run them to Mittagong?
 1391. *Professor Warren* (to *Mr. Hoyle*).] Do you want the coal and water consumption in each case? Yes; decidedly I think it is most important.
 1392. *Professor Warren* (to *Mr. Fehon*).] Well, that must be done; we shall have to run the engines as far as Goulburn.
 1393. *Mr. Fehon.*] Would Mittagong do as well? There is a turn-table there, and you would have the advantage of running up the 1 in 30 bank.
 1394. *Professor Warren.*] I would very much like to make the test a short one, if possible.
 1395. *Mr. Brown.*] You could run to Mittagong and back if you liked. Would not that be far enough?
 1396. *Mr. Hoyle.*] Would it not be better to go to Goulburn?
 1397. *Professor Warren.*] I would very much like to make the test right through without any interruption, and then we could balance up results afterwards.
 1398. *Professor Warren* (to *Mr. Howe*).] How long will it take you to fit up indicator-gear on the engines? I think there is already one of the American passenger engines fitted with an indicator.
 1399. *Professor Warren.*] We may take that one first, and make the necessary tests, and then you could take the cock from it and put it on to the others.
 1400. *Mr. Brown* (to *Mr. Howe*).] Could you have that engine ready by Tuesday? Yes; that could be done, although you could hardly use the same gear the next day. It would be better to make a break between the trials.
 1401. *Professor Warren.*] I would very much rather not have the trials on successive days, because I should like to balance up the results as we go along.
 1402. *Mr. Howe.*] Then may I make a suggestion that the work should be put in hand at once, and that the Commission should be advised as soon as it is ready. It is work that should not be done hurriedly.
 1403. *President.*] Quite so; I am most anxious that nothing should be done with undue haste.

Mr. Harry H. Park called in and was sworn:—

- Mr. H. H. Park.* 1404. *President.*] What are you, Mr. Park? A mechanical engineer.
 1405. In the Railway service of this Colony? Yes; I am locomotive inspector at Penrith at present.
 1406. How long have you been in the service? About three years and six or seven months this time.
 20 April, 1892. 1407. Had you experience in that kind of work before you came here? Yes, sir.
 1408. Where? Here, in Tasmania, and in England.
 1409. How long in England? In England I was engaged at the locomotive shops on the Great Western Railway, at Swindon. I was then for some time at Paddington in connection with the same company, and for some time after that I was on the London and Brighton Railway.
 1410. Tell me how many years' experience you had in England? I should think about three in England.
 1411. And how long in Tasmania? About eighteen months, and three years and six months here. I was three years in this Service, and then I left to take something else, but joined the Service again, and the last time I have been connected with it for about three and a half years.
 1412. Oh; then you were in the Service before? Yes; I was in the Service before. I have been connected with these railways about six and a half years altogether.
 1413. *Professor Warren.*] Then you have had about ten years experience? Yes.
 1414. *Mr. Hoyle.*] You are locomotive inspector at Penrith, I understand? Yes.
 1415. Is it your duty as locomotive inspector at Penrith to report to head-quarters—that is to say, to the locomotive engineer, through the proper channel, with respect to all failures of, and accidents either to, engines or parts of engines? Yes.
 1416. And do you follow out that practice? I do.
 1417. Can you tell us how long the Baldwin passenger and Consolidation engines have been doing the work between Penrith and Bathurst? Are you talking of passenger and goods engines?
 1418. Yes; I am talking of passenger and Consolidation and goods engines? Well, the passenger engines have not been stationed there very long, we have three stationed there, but one is in Sydney. We are only running three round trips a week with the passenger engines.
 1419. What do you mean by a "round trip"? From Penrith to Bathurst, returning the next day. In addition to this Nos. 5 and 10, to Mount Victoria are run by the new passenger engine.
 1420. And do you run the Consolidation goods engines from Penrith also? Yes.
 1421. Can you tell the Commission whether these engines have been in any way troublesome as to repairs necessary, since they have been under your control at Penrith? Yes, they have.
 1422. Have they cost more than, or been in the shop oftener for repairs than other engines you know of taking into consideration the length of time they have been running? Well, I must answer that question in this way; they are new engines, and I have not had any new engines excepting these to deal with since I have been there. I cannot, therefore, draw a comparison such as Mr. Hoyle asks with very great exactness. It is a comparison between the new machine and one in which the weak points have already been strengthened.
 1423. *Mr. Brown.*] But can you not answer that question from your previous experience as an engineer? Yes.
 1424. *Mr. Hoyle.*] What has been that experience? Well, the engines have contained a number of small details, not sufficiently strong to do the work which they ought to have been put to.
 1425. *Mr. Hoyle.*] And do you take it that the passenger engines are not sufficiently strong to do the work they ought to have been put to? No. The points that have given way have had scarcely anything to do with the drawing of the train at any rate. The particular things that have given way have been connected with the draw-gear—those engines have caused more delay in that respect than any other engines that I know of.
 1426. Do you consider the brake-gear defective now? Yes.

1427.

1427. In what way were the rods connecting the brakes weak? They were badly forged, and I think were not sufficiently strong enough had they been properly forged.

1428. *President.*] Have there been many failures of these rods? Yes.

1429. Do you know how many? Well, it would only be guess work.

1430. What do you think taking it at a rough guess—half a dozen? More than that, about a dozen times, as many as that I think.

1431. You say you report these matters? Yes.

1432. The reports are in existence I suppose? Yes.

1433. Your reports? Yes.

1434. They could be produced? Yes; I think so.

1435. *Mr. Hoyle.*] I will ask that they be produced.

1436. *President* (to *Mr. Fehon*).] Would these reports be in existence? Yes; I think they would form a part of the return that you have asked for with regard to repairs to engines.

1437. *Professor Warren.*] *Mr. Howe* would supply one part and *Mr. Park* would supply the other, I suppose.

1438. *Mr. Fehon.*] They would come from all parts of the Colony and be sent in to *Mr. Thow*.

1439. *Mr. Hoyle.*] From your experience of these engines at Penrith, do you know whether many draw-hooks have been broken? There has not been a broken draw-hook since they have been in the district.

1440. But have there been any broken draw-hooks on the engines? Yes; on No. 500 at Clarence Station.

1441. Did an engine come into the Penrith yard with the right first trailing-wheel loose? Yes.

1442. Had the wheel moved on the axle? Yes.

1443. How much? I should say about three seconds.

1444. Is it dangerous for a wheel to work like that;—is it not very dangerous? Not in its present condition.

1445. But would it be a dangerous thing for a wheel to work loose—such an important wheel as a trailing-wheel, I mean? It would be if it got loose to any extent.

1446. What is the number of that engine? No. 456.

1447. Has it been sent to Sydney for repairs? Yes.

1448. In what manner was this engine employed? On a train from Penrith to Mount Victoria.

1449. Was it a passenger engine? Yes.

1450. Are you aware, or does it come within your knowledge, that two engines run with one train;—have you anything to do with that in supplying the engines? Yes.

1451. Can you tell the Commission whether these Baldwin engines (passengers) have had to have a pilot to assist them up the Lapstone bank? Yes; I think they have had.

1452. They have had a pilot engine to assist them up the bank? Yes.

1453. Has there been an extra load on them? Yes.

1454. Is it a fact that the consolidation engine is taking the mail train, that is, the passenger train, from Penrith to Katoomba? Yes.

1455. Why do you use the consolidation engine? To prevent the necessity of using two.

1456. Then, do you say that the passenger Baldwin engine cannot perform the work without the assistance of another engine? You must let me explain that a little. The passenger engines are not used by the mail this side of Katoomba, but they are used by the passenger train leaving here at 10 o'clock from Penrith to Bathurst; that is how they are run at present.

1457. Do I understand that an engine takes the train from Sydney, and another engine picks up the same train (the mail train) at Penrith, and takes it to Katoomba, and another engine picking it up there and taking it on to Bathurst. In other words, that three engines are used between Sydney and Bathurst? Yes; that is so.

1458. Was that customary? Not until we used these big engines.

1459. As a matter of fact, you are now using three engines to do what was originally done by one? Yes.

1460. *President.*] What do you mean by saying what was originally done by one? One engine was only used on the trip, but we are using three now, because we are dividing the district between Sydney and Bathurst into two.

1461. Was there always an additional engine used for drawing the train up the hill? No; not always. It all depended upon the load.

1462. *Mr. Hoyle.*] Did the passenger engines ever run the train—I refer to the Baldwin engines? For a short time they did.

1463. But did ever the Baldwin engines take the mail train from Penrith to Bathurst or Katoomba? Yes.

1464. When they were doing that did they require the assistance of a second engine? Oftentimes.

1465. What do you say? Sometimes.

1466. *President.*] He said "oftentimes" at first, but now he has corrected himself, and says "sometimes?" —

1467. *Mr. Hoyle* (to witness).] You say that the Baldwin passenger engines, in doing that work, would require the assistance of a second engine? Yes.

1468. That was according to the amount of traffic on the road, I suppose? Yes; it depended on the load it had to draw.

1469. When you were using the pilot engine under these circumstances, did the pilot engine first go to Emu and hook on to the train there? Yes; since the Baldwin engines came here.

1470. My question is this, that you have had to use the Baldwin engine to assist the passenger engine up the gradient as a pilot engine, being hooked on at Penrith or Emu? Why, because of the viaduct. We could not couple the two engines at Penrith, so as to be such a weight on the viaduct between Penrith and Emu.

1471. Was any accident reported to you that a brake-down of one of the Baldwin engines on Friday last somewhere on the mountains? I am not aware of it, I cannot call it to mind.

1472. But if you heard of such an accident happening? Wait a moment.

1473. *Professor Warren.*] Last Friday, was it?

1474. *Mr. Howe.*] Yes, last Friday on the mountains. *Witness:* Yes.

1475. *Mr. Hoyle.*] You did hear of it then? Yes.

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1476. What was the cause of the accident? The poles came out of the eccentric strap and rod.
1477. And did the strap break? Yes, the eccentric strap broke.
1478. Where would it be reported—to Bathurst or Penrith? To both places.
1479. And the report sent will reach you? I cannot remember seeing the report, and I know that the matter has been reported and the breakage repaired.
1480. And what was the result of that accident, was the train stuck up till it had to get another engine? I do not think so.
1481. But when the eccentric strap broke, could the same engine pull the train home;—had they not to telegraph for another engine? I do not think so, but I cannot call it to mind.
1482. Would an engine be telegraphed for to your district or Mount Victoria if another engine was sent for? To the nearest station.
1483. What would the nearest station be? Hartley Vale, I suppose. No, Eskbank.
1484. Then the officer-in-charge at Eskbank would know all about it? Yes.
1485. Do you know what load the Baldwin consolidation engine hauls from Penrith to Katoomba? Yes.
1486. Then what is a load? Twenty-two trucks, including brake-van. I am now speaking of ordinary loaded trucks.
1487. How many loaded trucks would such an engine haul? Twenty or twenty-one, if there is only one small brake-van on the train.
1488. Do they have the assistance of an engine behind to shove up the hill when they have these twenty loaded trucks?
1489. *Professor Warren.*] What is the weight of one of the loaded trucks of which you speak? They would average about 10 tons.
1490. No more? Not more than the average load, taking one with another.
1491. Therefore, the whole train would weigh about 200 tons, and that would mean 200 on a grade of 1 in 30? Yes.
1492. Have they in both cases? Very little in the consolidation engines.
1493. How do you account for that? That is a question that I am scarcely prepared to answer.
1494. But in consequence of these axle-boxes having worn into the boss of the wheel, considering the short time the engines have been running, would you say that it was a defect in the design? I scarcely understand what you are trying to arrive at Mr. Hoyle.
1495. You say that the axle-boxes are wearing into the boss of the wheel, would that be caused by reason of a fault in the design of the engine? No; I think not.
1496. Would it be the result of bad workmanship? It might be to a certain extent attributable to the design of the engines for certain classes of work. If the boss were larger it would, evidently, not wear so quickly.
1497. Is it, do you think, caused through the boss being somewhat small? Yes; to some extent, I believe it is.
1498. To some extent? Yes.
1499. With your experience of locomotive work, do you consider that these engines are what they ought to be in workmanship and material? No, I do not.
1500. Have you known whether any of the turn-tables have broken whilst one of the consolidation or passenger engines has been upon it? Yes.
1501. One did break? Yes.
1502. Where was that? It was at Penrith.
1503. Do you think it was in consequence of the great weight of this engine that the turn-table broke? Yes, I do.
1504. Have you had anything to do since you have been there with the pistons? Yes.
1505. Have you found that the piston-head has worn very much? In one class.
1506. Which class is that? The compounds.
1507. And what would be the result of a piston-head wearing in that way, what would you have to do to put it right? We should have to put a new one in.
1508. You could not repair it without putting a new one in? No.
1509. Then, from your experience as an engineer, do you think that these piston-heads ought to wear so much in so short a time? With that design I am not surprised at it.
1510. Then, do you consider that the piston-heads in this case are very heavy, do you consider that wear was owing to the weight of the head? Yes, and to other things as well.
1511. Have you examined very minutely the wheels of any of these engines? Yes.
1512. Have you discovered any defects in them? I have seen what was an apparent defect.
1513. What is that? Well what appears to be flaw.
1514. Do you know if the spokes of any of these wheels are cracked? That is what I am alluding to.
1515. If they are cracked is not that a very serious thing? I do not think that they are unsafe.
1516. But is it not a serious defect for the spoke of a wheel to be cracked? Well, not necessarily. It is a defect I acknowledge.
1517. Then, if a wheel will run when it is cracked, do you not think it is a very grave defect, if not a very serious one? Yes.
1518. I will put it in this way—supposing any of these spokes are cracked, is there not danger of the defective wheel collapsing? No, I do not think so; at any rate, not at present.
1519. On how many wheels are spokes cracked? No. 457 is one. Just at present I cannot call to mind any other particular case, but that one I do remember, because I have been watching it for some time to see whether the defect went any further.
1520. But what I want to know is whether you are really satisfied they are really cracked in the spokes, or whether you merely think they are? Well, it is either a defect in the forging, or it is a crack; I am not sufficiently conversant with the mode of manufacture to say which.
1521. We understand from Mr. Thow, and also from Mr. Neale, that these wheels are made by a new process, or really by a new adaption of a new process.
1522. Are there any other wheels in the service made by that process? Not that I am aware of.
1523. Do you consider that these wheels are sufficiently heavy and sufficiently strong for the work they have to do? I will qualify it in this way by saying that I do not think they are as good as English wheels.
1524. And if you were designing an engine, you would not put these wheels on it, would you? No, I should not.

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1525. *Mr. Brown.*] Are they good enough for the work they have to do? They are for the present.
1526. *Mr. Hoyle.*] You say they are for the present, but do you think that in time these wheels might become wanting repair and unsafe? Yes, I think they might.
1527. Is that not unsafe? No.
1528. But you think it is necessary to keep close watch over them? Yes, I keep a close watch over them myself.
1529. Can you tell us whether there is any test mark in the fire-box of any of the Baldwin engines? What do you mean by a test mark?
1530. Is there any mark showing that these boilers have been tested at any time;—any mark in the fire-box, I mean? Not that I am aware of. There is a mark on the front plate.
1531. That I am aware of;—that is only the mark to show where the plate is manufactured, is it not;—it is not for the purpose of showing when the boiler was tested? No; it is a patent mark.
1532. But in testing boilers is it not customary to brand the date upon which the test was made on the fire-box? It is not a custom with all makers.
1533. But it is a custom in our service, is it not? Yes.
1534. Have you had any trouble with the tubes of these engines since they have been under your control? Not much more than with any others. We have had some trouble.
1535. Is it not a fact that you keep a fitter and his mate at Penrith specially to look after these engines? Yes, it is.
1536. It is a fact? Yes.
1537. Is it the case with regard to any other engines? I should like to explain what I mean. These are a special engine, and we think it better to entrust the duty of looking after them to a particular man, because we find that a man who gets accustomed to them, or indeed to any particular class of engines, can do twice as much work as a man who is not accustomed to them. Mind, he is not employed only upon these engines, but if there is anything marked up against a Baldwin engine it is his special duty to go and attend to it.
1538. *President.*] That is to say he understands Baldwin engines? Yes.
1539. Is it because he knows the weak points of the engines, or because he knows Baldwin engines better than any other man. Do you keep him employed upon the Baldwin engines I mean, because there are so many weak points in them, that he has already attended to, that he is especially familiar with their weak points, or because he has a better knowledge of the Baldwin engines generally than any other man? We find that when there is any special class of work to be done, it is better to keep one man employed upon it, as he knows where to put his hand upon the details of the work, and he knows where the weak points are.
1540. *Mr. Brown.*] Exactly; that is the very point we want to get at. The President asked you whether this man is especially conversant with the Baldwin engines, and whether it was for that reason that you employed him, and not merely because there are so many weak points in the Baldwin engines that it is necessary to have a special man to look after them? No; it is because he knows more about the Baldwin engines than the others, and I can get more work out of him.
1541. But not because he knows the weak points particularly? We employed him when the Baldwin engines first arrived, and he has so to speak grown up with them, consequently we get a good deal more work out of him than we should out of a man who was not so well acquainted with them.
1542. But you do not keep him for doctoring up these engines, because they have got weak points in order to keep them running. You do not employ him especially upon this work because the engines are a bad job, and have certain defects which this man is acquainted with? No.
1543. *President.*] You do not mean that he is a kind of nurse for these engines? No, he does other work as well, and other men do work upon the Baldwin engines if he has too much to do.
1544. This is a very important point, let us be particularly clear about it. I want to know exactly what you mean; is it because there are such a lot of weak points in these Baldwin engines, that you have to keep a man who understands their weak points; or do you keep a man who understands any particular kind of work, whether it be work in connection with Baldwin engine or an English engine, for that particular work, because you can get more work out of him—in other words, because he is a sort of specialist? That is so.
1545. *Mr. Hoyle.*] Have you reported these defects, as you think they are in the wheels, to head-quarters? No, because they have not gone so far that I consider them dangerous.
1546. *Mr. Brown.*] Have they not gone so far as to warrant you making report upon them? No.
1547. *Mr. Hoyle.*] Do you know whether, since these engines have been under your control, there has been any failure in the reversing gear? Yes.
1548. Will you explain what has been the nature of that failure? The first that I can call to mind was an engine stationed at Bathurst. In that case the pin that carries one of the minor wheels came out, and the bracket worked loose in the train.
1549. And what was the result? Well, they managed to get it into Penrith; I cannot call to mind whether there was any delay; I think that there was, but it had to be repaired before it came out again.
1550. Was any accident on the mountains reported to you as having occurred on Saturday last? Yes.
1551. What was the nature of that accident? A truck and tender jumped the road.
1552. Has there been any inquiry in regard to it. Have you had anything to do in regard to it? Yes, I was examined yesterday.
1553. And what was alleged to be the cause of the accident? I did not hear any evidence. I gave evidence, but did not hear the evidence given by anybody else.
1554. Have you any idea what caused the truck and the tender of the engine to leave the train? I cannot offer my opinion. All that I can tell you with regard to it is this, that I saw the road at the point on which the accident occurred, and I also examined the wheels of the tender, and with this result: that I found that both rail and road and tender-wheels were in good order so far as I could see. I had not time to examine it very much, as a passenger train was being delayed all the while.
1555. Did any report reach you of an accident that happened on the second Zig Zag? No, I had nothing to do with it.
1556. But as a matter of fact, a train did leave the road there, did it not? I believe so.
1557. Have you discovered with regard to the wheels of the tender wheels that any of them are loose? Yes.
1558. Do you know that one of the tender axles is loose in one of these engines? Yes.

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1559. *Mr. Fehon.*] If you will allow, I will suggest that Mr. Hoyle is travelling a little outside the scope of this inquiry. He is asking questions about engines that have nothing whatever to do with the Baldwin Company's engines.
1560. *President.*] I understood that he was referring to a tender attached to one of the Baldwin engines?
1561. *Mr. Fehon.*] No, he was not.
1562. *Mr. Hoyle.*] The last instance that I referred to had no reference to a Baldwin engine, but my reason in asking the question was that I wanted to know whether there was anything the matter with the road?
1563. *President.*] Then ask the question simply whether there was anything the matter with the road?
1564. *Mr. Hoyle* (to witness).] You say that you have discovered one of the axles loose in the tender of the Baldwin engine? Yes.
1565. Have you reported it? Yes.
1566. What number is it? It is No. 499.
1567. How many wheels are there loose? Two wheels loose on No. 499.
1568. Has that engine been sent to Sydney for repairs? No, I repaired it myself. I got new wheels from Sydney.
1569. And you had to put new wheels on these axles? No, I put new axles and wheels on.
1570. You put new axles as well as new wheels? Yes.
1571. Let me ask you a question in regard to this axle that has worked loose on the trailing-wheel; that has worked loose, will a new axle have to be put in to replace it? I should think so.
1572. You will have to put in a new axle, you say? Yes, I shall, so far as I can judge from appearances at present. I think it will have to be a new axle.
1573. For what reason? Because it is too small for the hole in the wheel.
1574. Would it have been dangerous to run this any further than it had gone when it was discovered to be loose? I do not think it would have been dangerous, but, on the other hand, I never have sent it out knowing it was loose.
1575. And you say that engine was repaired at Penrith? That tender.
1576. By putting new wheels and axles on? Yes.
1577. Have you had much experience of the Compound engines? Well, they have been run more or less every day.
1578. Are they giving general satisfaction? In what respect?
1579. *President.*] I do not think that general satisfaction has anything to do with it. You should make your questions more specific.
1580. *Mr. Hoyle.*] Are there any defects about the Compound engines? Well, the brake-gear is the same as on the Consolidation. That gave way, but I do not know of anything else in particular.
1581. Is there anything wrong with the speed of these engines—are they very slow or very fast? They are slow.
1582. *President.*] Those are the Compound that you are speaking of? Yes; Nos. 500 and 502.
1583. *Mr. Brown.*] Are they, in your opinion, doing good or bad work for the railway service? I cannot say that I think they are doing good work.
1584. *Professor Warren.*] Will you supply us with drawings of the Compound similar to those you have supplied us with of the passenger and Consolidation engines? ———
1585. *Mr. Fehon.*] I do not think we have the drawing of the Compound engine.
1586. *Professor Warren.*] I do not mean the drawings—I mean the diagrams, similar to what we have here.
1587. *Mr. Fehon.*] Oh, yes; we can furnish you with them.
1588. *Mr. Hoyle* (to witness).] Did Mr. Neale visit Penrith, as far as you know, for the purpose of examining these engines, or of making any inquiry at all with regard to them upon one occasion? Yes.
1589. Will you tell the Commissioners what inquiries he was making, or what there was defective about these engines that he inquired into? They were not doing sufficient work. That is, not doing sufficient work, considering what they were expected to do.
1590. You believe that Mr. Neale went up to Penrith to inquire into the allegation that these engines were not doing sufficient work? Yes.
1591. Did Mr. Neale state that to you? No; I do not think he did. In fact, I believe I was away when he came there.
1592. As a matter of fact then, are these engines not doing the work that they ought to be doing? They are not doing the work they were expected to do. Mind, I am only saying that from hearsay evidence.
1593. *President.*] You ought not to do that; we do not want hearsay evidence from you; these questions have reference to what you yourself actually know; do you yourself say that these engines are not doing the work they were expected to do;—you do know what work they were expected to do, I suppose? Only from hearsay.
1594. What work were they expected to do, did you hear? The same work as the Consolidation engines.
1595. What work did they not do?
1596. *Professor Warren.*] Will they pull the same loads that the Consolidation engines? No.
1597. *Mr. Fehon.*] I may mention that the two Compound engines are what are called experimental engines. The Compound engines are a new departure in America, but we thought it was desirable as we were ordering American engines to order two Compound engines, in order that we might see what they could do. They were therefore not ordered to do any given amount of work.
1598. *Mr. Hoyle* (to witness).] Do you think that these Baldwin passenger engines would be perfectly safe going round a sharp curve at a high rate of speed—going round a 10-chain curve for example? It all depends upon what you call a high rate of speed.
1599. Well, perhaps you will tell us what is the average speed that the Baldwin passenger engines could make to keep time according to the time-table, say between Katoomba and Bathurst. Is it 30 miles an hour? Yes, I think so. If you will give me a minute to consider. Well, I think they would be safe to run over that portion of the line at 40 miles an hour.
1600. Do you consider that it would be safe for these engines to take a 10-chain curve at 40 miles an hour, taking into consideration the height of the boiler above the wheels? Yes; I judge it from the way they have acted when I have ridden upon them.

1571. *Professor Warren.*] But have you ridden upon an engine running at the rate of 40 miles an hour round a 10-chain curve? No, sir, we do not do it.

1572. *Mr. Hoyle.*] Was any order issued to your knowledge relative to the speed of the Consolidated engines? Yes.

1573. What was that order? The order was to the effect that the engines were not to exceed a rate of 18 miles an hour.

1574. That they were not to exceed 18 miles an hour? Yes.

1575. Can you say why that order was issued? No; there was no reason given to me. I simply got the circular.

1576. *Mr. Brown.*] As a matter of fact is it because the Consolidation engines are cart-horses, and are not supposed to do the work of race-horses? I should think that had something to do with it.

1577. *Mr. Hoyle.*] No, that is not the point at all Mr. Brown.

1578. *Professor Warren* (to witness).] Have you received any similar instructions in regard to other goods engines? No.

1579. Then the instructions with regard to not exceeding 18 miles an hour were issued simply with regard to these particular engines? Yes.

1580. *Mr. Brown.*] But, as a matter of fact is it not because one is a cart-horse and the other is a race-horse?

1581. *Mr. Hoyle.*] There may be something in that, but these Baldwin Consolidation engines are very much heavier than the passenger engines, and to run them fast would be to injure the permanent way.

1582. *Mr. Brown.*] Yes, but that is because they are cart-horses.

1583. *Mr. Hoyle.*] Yes, but what I am coming to is this—if they are only supposed to go 18 miles an hour, then in attaching them to the mail trains they are using a cart-horse for the purpose of running a sulky. Why do they not use their race-horses for that purpose.

1584. *Mr. Fehon.*] Eighteen miles an hour has always been the time-table rate for any engines travelling up the mountain gradients, it matters not whether it is a big engine or a little one, or whether it is a train drawn by two engines or by one engine; 18 miles an hour is the time-table rate of speed, and has been all along.

1585. *Mr. Hoyle* (to witness).] Do you know whether, at any time, any of the trains going to Sydney have had to drop a portion of load so that that portion might be put on to the train that is drawn by these Baldwin engines? Do you mean working between Penrith and Sydney?

1586. Between Katoomba and Sydney;—I will put it this way—do you know of any train down from Sydney to the west having dropped any portion of her load in order that it might be put on to the train attached to the Baldwin engine to be drawn to Penrith? No, I am not aware of it.

1587. *President* (to Mr. Hoyle).] After what the President has said with regard to the applicability of the instructions that trains are not to run faster than 18 miles an hour over the mountains to all trains, do you particularly want the printed instructions the witness admits having received with regard to the Baldwin Consolidated engines?

1588. *Mr. Hoyle.*] Undoubtedly, Mr. President, because I have not studied the time-table—(to witness)—and you do not know whether any other truck load has had to be given the Baldwin engines to carry? No, I am not aware of it.

1589. *President* (to Mr. Fehon).] Are there any questions that you would like to put, through the Commission, to the witness?

1590. *Mr. Fehon.*] There is one question that I would like to put to Mr. Park, not in the way of cross-examination, but more in the way of correction;—Mr. Park stated that it was a custom for two engines to take the load from Penrith to Katoomba;—does Mr. Park know that two engines take the train from Katoomba to the west? The push-up engine does.

1591. Does not the push-up engine return to Penrith? No; that is, it depends on how much load there is on.

1592. If there was a push-up engine, would she not return to Eskbank.

1593. *President.*] Supposing an engine start from Penrith and assist the train to get up to Katoomba, does that second engine go further west than Katoomba, or does it come back to Penrith? It is according to the load that is on the train, and also according whether the engine is going to Eskbank or Wallerawang.

1594. Exactly; then it amounts to this;—does the second engine proceed with the train west of Katoomba for the purpose of assisting with the hauling of the train, or as a mere matter of convenience, dependent upon whether it is going to Eskbank or Wallerawang? Both; sometimes when a train consists of a double load the engine will proceed with it west to Katoomba for the purpose of assisting by pushing the train, and sometimes it will go further west merely for the sake of returning to its destination.

1595. *President* (to Mr. Fehon).] Does that answer satisfy you?

1596. *Mr. Fehon.*] There may be exceptional cases of that kind.

1597. *President* (to witness).] Do you say that these Baldwin engines are now defective? Most of these small points have been rectified.

1598. Are they merely small points, such as might occur in connection with any new kind of engines? Yes, sir.

1599. And are all things that you have mended things that might occur in any new and, to a certain extent, experimental engines? Yes.

1600. I believe the Baldwin engines are new, so far as our railways are concerned, are they not? Yes; we have engines from the same firm that have been working here for years.

1601. Yes; but I am referring to what are better known to the public as Baldwin engines;—they are new here, are they not? Yes.

1602. Have there been more repairs done to them than would have been effected in the case of newly-imported English engines? I think there have been.

1603. You think that the English engines would have been more perfectly finished? Yes. There would have been better work and better material in them.

1604. Are the English engines much more expensive than these? You can scarcely say.

1605. Having made all these repairs, do you say whether the engines are now defective or not? In the minor parts that have been already repaired?

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1606. Now you have mended those minor parts, you say, and substituted things where they were wanted;—are these new engines now defective;—on the 15th of March last were they defective? I cannot say that they were.
1607. Do you think that they were unsuitable for the permanent way of the Colony? That is a question that I am not prepared to answer. It is a question for a civil engineer, not a mechanical engineer.
1608. Do you say that the Baldwin engines—I am not referring to the compound engines, they were a mere experiment;—but do you say that these Baldwin engines are not doing the work that was expected of them? No; I do not say that.
1609. Do you think that they are doing the work that is expected of them? Yes.
1610. *Professor Warren.*] You were speaking just now as to the load these engines would take up inclines, and you stated that they would take up twenty loaded trucks;—were you speaking of Consolidation or of passenger engines? Of Consolidation engines.
1611. Do you know how many the passenger engine will haul;—I take it that they have been used for hauling trucks? I cannot say from memory.
1612. My only object in asking the question was to see whether a test with 144 tons was too much.
1613. *Mr. Fehon.*] 144 tons was on a grade of 1 in 40.
1614. *Professor Warren.*] No, I think not. The grade referred to was undoubtedly 1 in 30.
1615. *Mr. Hoyle* (to witness).] The President asked you just now whether these engines were not more costly to repair than new engines usually are. I wish to ask you whether you know of any case in which new engines have had to have their bogie axles and some of their tender axles renewed so soon after running? I cannot say that I have.
1616. Is it customary, is it usual, or is it not an extraordinary thing for such repairs to be necessary to engines so soon after they have begun to run? It is unusual with English engines.
1617. But during your experience in the service do you know of any other American engines in which the axles have had to be renewed so soon after their arrival? I cannot say from my own personal knowledge.
1618. But from your personal knowledge do you know of any such repairs having been made to them? No.
1619. But do you consider that a loose axle is not a defect? I have not said there was a loose axle.
1620. You have just sworn it? Yes; but I mean in running condition.
1621. But that axle was loose since the 13th of March, was it not? Yes.
1622. That was a defect? —
1623. *President.*] I would like to understand about that loose axle; is it a kind of thing that might happen at some time by an accident to any engine, or is it a very special or unusual thing to happen? I think it was put on a little too loose in the first instance. Axles are put on under certain pressure, and I think this one was put on at a low pressure. I do not think that the pressure was ever required for this one.
1624. You do not think that great pressure was ever used? No; because it was not needed. It would probably go on at a lower pressure.
1625. Might that happen in connection with any other engine; I mean an English engine? Yes.
1626. Have you known it to happen? Yes.
1627. Then taking everything you can against the engine, is there anything to show it to be outrageously bad because of that axle being loose? No.
1628. It might happen to any engine, I suppose;—if an axle had been put on at not a very high pressure is it a thing that might occur to it? Yes. For instance, if a wheel was put on at a pressure of 30 tons it would not be as safe as if it had been put on at a pressure of 80 tons.
1629. *Mr. Brown.*] If you had the ordering of these engines, would you order these same engines from the Baldwin Company? I would not care to say that.
1630. *President.*] Some people, I believe, like English, and some American engines better; which do you like? For good workmanship I like an English engine, but for good hauling power, I like an American engine.
1631. By good workmanship you do not mean mere finish? No; I mean good material and design.
1632. But for doing the work you like the American engine? Yes.
1633. Will not the English engines do the work as well? I do not think they do. I do not think they haul as much in comparison to their size.
1634. *Professor Warren.*] Not the newly imported English engines? I have had no experience of them.
1635. You could not compare one of those Baldwin engines with such an engine as we had before the new English engines arrived? No.
1636. *President.*] No, but take engines for heavy hauling power, do you think the American engines are better than the English? I do.
1637. *Professor Warren.*] If they have the same weights on the driving-wheel, the same cylinder power, and the same heating surface? I do.
1638. *Mr. Hoyle.*] Can you tell us the difference in the load between the new Consolidation Baldwin engines, and the old Consolidation engines? Yes.
1639. *Professor Warren.*] It was something like 75 tons.
1640. *Mr. Hoyle.*] What is the difference in the load? I think it is about six trucks.
1641. *Professor Warren.*] That is 54 tons.
1642. *Mr. Fehon.*] Yes, that is the average weight.
1643. *Mr. Hoyle.*] You do not consider that it would be unsafe for the draw-gear if the Consolidation engines are engaged in drawing twenty loaded trucks weighing altogether about 200 tons? Not with the proviso that there is plenty of brake power.
1644. But is there not plenty of brake power on the trains? As far as I know there is; I am not responsible for that.
1645. If this very heavy load was taken up the 1 in 33 or the 1 in 40, would it require vigilance on the part of the men with the train? Most decidedly, if there were only six trucks.
1646. *Mr. Fehon* (to the President).] I have spoken to my colleagues on the question of the trial-trip, and they seem to think it would be expensive, and that it would to some extent disarrange the working of the traffic if they carried out as has been suggested by the Commission. They have therefore asked me to put it to you whether you consider it is absolutely necessary that three separate trials should be made.

So

So far as the Baldwin engines are concerned we should be happy to give any trials that might be needed, it being the object of the inquiry to deal exhaustively with them; but to give tests with other engines it seems to us it scarcely comes within the scope of the inquiry. We could, and would give you returns with regard to the power of the other engines, their coal consumption, and so on, but to make actual tests such as Professor Warren proposes would be an expensive matter.

1647. *President.*] If you have the data that Professor Warren wants he would not want the tests that is quite plain.

1648. *Professor Warren.*] They have not got the data.

1649. *Mr. Fehon.*] We can give you the data upon which we are working the railways—the data which is after all the best practical test. Scientific test would give a slightly different result, but the result would be so slightly different that it would amount to a mere nothing. We can give you the load which it is safe for an engine to carry, and that is the beginning and end of the question involved in the trial. At the same time let me say, that if you wish to make any examination with regard to the Baldwin engines, we will give you every facility at our disposal to make it.

1650. *President.*] Mr. Brown and I must be guided entirely by what Professor Warren thinks in this matter. I should never think of exercising my independent judgment.

1651. *Professor Warren.*] Mr. Thow said that he could only give this information in a very rough way; indeed, and that is why I am asking for it now. As far as the expense of the test is concerned, I shall supply the indicator, and shall make the tests myself. It is merely a question of supplying us with an engine and trucks. My object in asking for the third test is to compare the Mogul engine with engines intended for the same class of work. We are not really testing the Baldwin engine against the English engine, and if the English engine beats the Baldwin engine, that would not influence us to any extent.

1652. *Mr. Fehon.*] Of course, we leave to the President the question of whether the test of other engines than the Baldwin engine comes within the scope of the Commission.

1653. *President.*] What we have to inquire into is whether these engines are defective, or in any way unsuitable to the permanent-way of the Colony as a railway, or whether they are performing the work for which they were ordered. Personally, I do not see exactly how this test would bear upon the question, but Professor Warren says that it does bear upon it. He says that if he could compare these different engines it will help him in his decision as to whether the Baldwin engines really are defective in any way, or unsuitable to the permanent-way of the railways. I only want you to understand that in the first place Professor Warren is associated with us for the purpose of helping us in this matter, for I know nothing about engineering, and though Mr. Brown knows a little he certainly does not know as much as Professor Warren, and not so much about railway engineering as he personally might know about other kinds of engineering. As I say, at present I do not see where the materiality of the tests in regard to the other engines than the Baldwin engines comes in. I can well understand the necessity for a test of the Baldwin engines; but Professor Warren points out to me that if he finds that there is a tremendous difference in the consumption of fuel in the Baldwin, that is to say, if they consume a great deal more fuel than the other engines that would be a defect in the engine.

1654. *Professor Warren.*] If it is a very large difference, but we shall get the speed up the Picton incline and get the horse-power in each case.

1655. *Mr. Brown.*] Personally I endorse every word that the President has said, but Professor Warren is here as a professional engineer, and if he wishes these steps we cannot stand in the way of them.

1656. *Professor Warren.*] If the Commissioners make a decided objection, then I do not think I shall press the point; but I cannot understand why they should object to have these tests made, because as Mr. Eddy said himself he intended to make them, but for so far had not been able to do so.

1657. *President.*] The only question is whether convenient.

1658. *Professor Warren.*] Well, it would be more convenient to the Commissioners if we made the test ourselves.

1659. *Mr. Brown.*] They say that they can give you all the information necessary for practical purposes, and you say they cannot.

1660. *Professor Warren.*] I am quite sure they cannot, because I asked Mr. Thow. If you make a test of any new thing you always make a mental comparison with what something else does, and that is precisely what I want to do in this instance.

1661. *Mr. Brown.*] You have heard the wish of the Commission about it, and you can now confer with your colleagues.

1662. *Mr. Fehon.*] I would only ask the President whether it comes within the scope of the Commission?

1663. *President.*] Professor Warren thinks that it will enable him to arrive at a conclusion, and that alone is sufficient for us, and would be if even we differed much more than we do from him. We are not now writing a report in which if we each held different opinions we should hesitate about signing it, but here is a test that he says will help him to arrive at the decision, and I do not see how we can resist it in any way, or how, because I, in my ignorance, cannot see why Professor Warren wants these results, can oppose him.

1664. *Mr. Brown.*] We have really gone further than we ought to have gone in publicly admitting that there was a want of unanimity on this point. The best thing you can do, Mr. Fehon, is to confer with your colleagues.

1665. *Mr. Fehon.*] I will withdraw the question, and confer with them.

1666. *Professor Warren.*] And if the Commissioners still object, although I say again that I think the tests are most desirable, we shall have to be content without them. I shall have asked for them, and have been refused; at all events, I have done my duty.

William Wilson, being sworn, said:—

1667. I am locomotive inspector in the Railway Service of this Colony.

1668. *President.*] How long have you been in the service of the Railway Department of this Colony? I have been in the Colony between seven and eight years, engaged in the Railway Department.

1669. What were you before that? I have had twenty-eight years' railway experience—that is to say, twenty years before I came here, and eight years since.

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1670. In the same class of work? Yes; I am a fitter by trade, and I have gone right on.
1671. *Mr. Hoyle.*] Have you had much experience with regard to these engines, since you have been in Bathurst? Yes, nearly all the time I have been in Bathurst—that is during the last five or six months.
1672. Have you found these engines to be very expensive to repair? Well, yes, they have been a little expensive in repairs, the same as all new engines, I suppose.
1673. Have they not been more expensive than ordinary new engines—English engines, for example? Well, seeing that the axles have had to be changed on a number of them, I suppose they have been more expensive.
1674. Have there been any break-downs in these engines in your district? They have not broken down very often.
1675. But have there been any break-downs? Yes.
1676. Will you explain to the Commission what the nature of these break-downs was? It was through the reversing gear.
1677. And has the engine actually broken down, and been unable to go on the journey? No, we have always been able to go on with the journey.
1678. There was an accident upon Friday last on the Mountains;—was it reported to you? No.
1679. Have you any knowledge of that accident? I do not know anything about it.
1680. Have you, since these engines have been running, stripped one of the Consolidation engines at Bathurst of a number of its parts, in order to enable another engine to run? Yes, I did so.
1681. Why? On account of the parts being broken, and in order to keep the traffic going.
1682. You had to strip one engine in order to keep the other running upon the line? Yes.
1683. What were these broken parts? There was a broken rocker arm.
1684. *President.*] What is a rocker arm? It gives motion to the slide-valve; it is a rod with arms on each side to give motion to the slide-valve. It moves backwards and forwards.
1685. *Mr. Hoyle.*] Was not there more than one part of the engine broken? No.
1686. Was there no part of the piston broken; was the rocker arm the only part that had to be taken from the engine—the only part that had to be dealt with? Yes. If by putting one engine in the dock we could make another right for the road we thought it would be better to do so—better than having both laid up.
1687. Have you ever examined these engines minutely? Yes.
1688. Have you found any defects in the wheels? Yes, apparently.
1689. Have you found any holes in any part of the wheels? No, I have not.
1690. Have you examined No. 456 engine minutely;—it is a passenger engine? No, that is not in my district.
1691. Have you ever examined engine No. 457? No, that also is not in my district.
1692. Are you sure of that? Yes, it is in the Nyngan, Dubbo and Bathurst District, she runs from Dubbo, and sometimes gets to Bathurst.
1693. It is engine No. 457 that I am referring to, Mr. Park says, with regard to this engine that he has examined her minutely, and there are flaws in her wheels, she runs to Penrith sometimes? No, I do not know the engine that I know of, she is not stationed at Bathurst.
1694. You have stated that you found no defects except those in the wheels of these engines, you would necessarily examine them when they came into your sheds? Yes.
1695. *Mr. Brown.*] Not only these particular engines, but any other engine that came to your shed.
1696. *Mr. Hoyle.*] Could you tell us the numbers of the engines in which there were apparent defects? Nos. 446 and 447.
1697. What were these apparent defects? They seemed as if they were cracked in the spokes of the wheels.
1698. Was this a passenger or Consolidation engine? A passenger engine.
1699. I presume you have not subjected them to any other test than closely looking at them? No.
1700. Have you ever sounded them with a hammer, do they appear to be cracked? I should not think there was anything wrong with them from the sound of the wheels, I am sure that if that test alone were relied upon they would seem to be alright; I am sure on these grounds that they are alright.
1701. Did any of the axles in any of the engines work loose? Not lately.
1702. But have any of them at any time? Yes.
1703. What numbers were they? I do not remember, but I think No. 493 was one.
1704. In what respect did that work loose? The wheel worked loose in the bogie axle.
1705. Is that since the alterations have been made, or was it before? Before.
1706. Have any of the wheels worked loose on the tenders? There have been but not lately.
1707. They were, I presume, the old axles that were originally in the wheels, they were not any of those which had been renewed? Yes, I think so.
1708. You have had some of the axles which have been loose, did you make the defects good, or were they sent to Sydney to be made good? They were sent to Sydney.
1709. Have you found any defects whilst you have had to do with these engines with regard to the brake-gear? No, but it has been broken considerably.
1710. What were the defects there? I think it was the rough handling of the brake attached to the engine.
1711. Do you think the brake-gear rods are strong enough for the amount of pressure that must be put on these engines in order to control them? They are proving that now.
1712. What were the breakages caused through? I think they were owing to the excessive use of the Westinghouse brake, and the drivers use the brake too roughly.
1713. Can you give us the names of some of the drivers who drove these engines? Yes; they were Fullerton, Evans, Hordern, and Moses—do you want any more?
1714. They will be enough;—did these men drive the engines regularly? Yes.
1715. And you think the failures of the brake-gear have been caused through the rough usage the drivers have given these engines? I do.
1716. *Professor Warren.*] Do you know the name of the driver who was in the Westinghouse brake trials recently? No, I do not.
1717. Do you know a Mr. Fisher? Yes; I think it was Mr. Fisher.
1718. *Mr. Hoyle.*] Do you know whether any of the draw-gear was broken on these engines? I have had one to mend, it was a tender draw-hook.
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1719. Was it one of the new draw-hooks? Yes; it was a long and strong hook.
 1720. Can you tell us how it was broken? It was broken through the bend of the hook.
 1721. But where was it broken, what place? When the engine was hauling a train.
 1722. Was it a passenger or a goods train? It was a passenger train.
 1723. *Mr. Brown.*] Did the train break away in consequence? No.
 1724. Were they running on a level or not? I do not remember, but I think it was on a slight incline.
 1725. And the train was, I suppose, stopped by the guard? Yes; the guard's brake is qualified to hold the train.
 1726. Have there been any other breakages connected with other parts of the engine? No, I do not think so; I do not know of anything else except the reversing gear, and I spoke about that.
 1727. *Mr. Hoyle.*] Do you keep a fitter and his mate at Bathurst especially to look after these engines? No; we do not. But the fitter and his mate are employed there looking after all passenger engines, or rather I should say a fitter, he has always been employed there in order to look after the passenger train engines.
 1728. Do these engines draw a larger load in the passenger traffic than the old engines used to do; do they draw a greater load ordinarily? Yes.
 1729. Why if that—is it on account of the increase in the traffic; has the traffic increased so much that these engines are required to draw a heavier load? We require fewer engines to do the work now, and there are bigger loads.
 1730. When the passenger trains were running, before the Baldwin engines arrived, were two of these engines employed to do the work of one now? Yes.
 1731. Were they doing it regularly? Not regularly.
 1732. Have any of these passenger engines required the assistance of the second engine? Never that I know of.
 1733. What kind of engine had you before? The Dubbs' engine.
 1734. And have you used the second engine to assist that? No; I cannot remember it.
 1735. You ought to remember that. Do you think you have ever used a second engine when one of these was doing the work? I cannot swear.
 1736. Do you think you have? I think it was very probable that we have.
 1737. You have, of course, some Consolidation engines at Bathurst? Yes.
 1738. Have you any difficulty with these engines at all with regard to the turn-table? Well, they are harder to turn round according to the weight.
 1739. But have you ever had any breakages there—I mean with one of these engines? No.
 1740. How many men does it take to turn them round? It depends upon the state of the turn-table.
 1741. *Mr. Brown.*] That was rather fine, Mr. Hoyle; I think you might give it generally, without going into details of this kind.
 1742. *Mr. Hoyle.*] Then you do not know of any other breakages than those you have mentioned? —
 1743. *Mr. Fehon.*] The witness has stated that a wheel got loose on the bogie. I would like to know whether it was on an engine bogie or a carriage bogie? It was a tender bogie.
 1744. Was it before or since the new axles were made? Before.
 1745. *Mr. Brown.*] I think we should sit on Friday.
 1746. *Mr. Hoyle.*] It would be of great inconvenience to me to do so. I am an auctioneer, and sell on every Friday. I have to pay a man to take charge of my business while I am absent at this Commission.
 1747. *President.*] Well then, Mr. Hoyle, we shall not sit on Friday.

THURSDAY, 21 APRIL, 1892.

[The Commission met at 2 o'clock, in the Board Room, Colonial Secretary's Office.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

ALEXANDER BROWN, Esq., J.P.

1748. *Mr. Fehon.*] Mr. President, the witness, Mr. Wilson, who gave evidence before the Commission yesterday, is present in the room, and he would like to be called again, as he wishes to make some slight correction with regard to the evidence he gave when last before you.
 1749. *President.*] If Mr. Wilson wishes to correct some statement he gave in evidence yesterday, we shall permit him to be called again.

William Wilson, recalled, said:—

1750. I wish to correct a statement I made yesterday with regard to a wheel being loose on the axle. I said that it was an axle of one of the bogies; I should have said it was an axle on the tender, and not the bogie.
 1751. *President.*] I understand it is the custom in these proceedings, to let the witnesses have a copy of the evidence, and I should think that that would be the better course, to let each witness have a copy of the printed evidence, so that he may have an opportunity of reading over his evidence, and if he wishes to make any corrections as to what he has stated, then I think he should come here and make them on oath. All the witnesses, if they wish it, will be furnished by the Secretary with copies of the evidence they have given, and then they may add anything they want to add to it.
 1752. *President* (to Mr. Hoyle.)] Do you want to ask this witness anything further? No.

William Pilford, being sworn, saith:—

1753. I am Shed Inspector in charge of the Newcastle District, and I have been sixteen and a half years in the Railway Service of the Colony.
 1754. *Mr. Hoyle.*] Were you in charge of the Newcastle shops since the Baldwin passenger engines or Consolidation goods engines have been running in that district? Yes; the passenger engines.
 1755. Were you in charge of the Newcastle shops when these engines went there first; can you tell us whether at any time whilst these engines were there any of the wheels were taken off any part of the engine and put in the lathe, either the bogie tender or engine wheels? The bogie only. The bogie axle and tender axle were taken from under the engine and put in the lathe.
 1756. Why did you put it in the lathe? To clean up the journal.

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1757.

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1757. When you had any of these wheels in the lathe, did you find one wheel larger than the other? There was a slight difference of not more than one-eighth—if my memory serves me it was about a bare eighth. You find differences in any ordinary engine. If my memory serves me it was about that.
1758. Did you true the tyres up in the lathe? No; the tyres were never trued up.
1759. Will you swear that the tyres were not trued up? I shall.
1760. Were any of the axles broken? None belonging to the Newcastle district.
1761. I mean of the Baldwin engines;—did any of them come under your inspection? Not under my inspection. There was one axle broken, but it was in the Sydney District.
1762. Was an engine brought into the Newcastle district with a broken axle? No.
1763. Where did this axle break then? At Redfern tunnel, I believe.
1764. Was there no other axle broken with the journal twisting during the time these engines were running in your district? There was one tender axle which came into the Newcastle district with the journal twisted off.
1765. Why was that? It was through the neglect of the engineman in charge.
1766. Who was the engineman in charge? I think it was Vincent.
1767. What was it caused through? Running hot, at least I should take it to be so at first.
1768. Was it customary for other axles to twist off,—I mean the axles of other kinds of engines;—do you know of any others with the journals twisted off in that way? No; I have no recollection.
1769. Was the rocking-shaft of any of these engines taken off? Not to the best of my belief, so far as I can recollect there was no rocking-shaft taken off.
1770. *Mr. Brown.*] Could such a thing be done without your knowledge? It might, if I were absent.
1771. *Mr. Hoyle.*] Then who would be present during your absence? The shed foreman, Mr. Richardson.
1772. Under whose notice would this come, under that of the man on the day-shift? Yes.
1773. Did you find anything wrong at any time with the link motion? No.
1774. Would that also come under the notice of Mr. Richardson if you were away for any length of time? I would only be away a day or two on duty in my district, or attending the head office on duty. It would only be a day or a day and a half at the outside.
1775. Was the tender axle sent to Sydney when it was broken? Yes; it was sent for inspection.
1776. Then it might be placed for the inspection of Professor Warren, if he wished to inspect it? I do not know where it is now; it was sent to Sydney.
1777. And it was a tender axle you say? Yes.
1778. Do you know, whilst these engines were running in your district, whether they were ever lifted, and at what place. How often were they lifted on any particular journey at any point in your district? They ran from Sydney to Newcastle and return, and the same from Newcastle to Sydney and return.
1779. Were there none running from Newcastle to Wallangarra? None for running the train.
1780. Why did they go there then; did they go over the line without a train; was it a trial trip? I cannot say.
1781. Was it to try the platforms? That I cannot swear positively to.
1782. Did you go with the engine? No.
1783. Who went with it; was there any officers besides the driver and fireman? I think there were Mr. Halligan and Mr. Robinson, of the Locomotive Department. Mr. Halligan is the Divisional Engineer of the Northern District.
1784. Do you remember an engine being fitted in the Newcastle shop with a gauge on its side to try the platform?
1785. *Mr. Fehon.*] I object to that question being asked Mr. President, it refers to other engines than the Baldwin engines, and this inquiry is limited entirely to the Baldwin engines. I ask if Mr. Hoyle can be permitted to carry on such an official inquiry as he is at present endeavouring to do, he has not brought forward a single fact since I have been here, but has only been fishing for information to build his case upon, I contend that he should be confined entirely to the question of the Baldwin engines.
1786. *Mr. Hoyle.*] I contend that I am well within my rights, I asked if an engine was fitted up with a gauge on its side to try the platforms along the line, I mean an ordinary engine. The gauge was intended to ascertain the distance between the platform in anticipation of the arrival of the Baldwin engines, I want to know if such an engine were fitted up with a gauge for the purpose I have referred to? Not in my time, I had no idea of any engine being fitted up in the Northern District for that purpose.
1787. Were there many repairs made to these engines in the shops? A fair number of repairs.
1788. More than to any ordinary new engines? In some cases, but not in all cases.
1789. Did you find any trouble with regard to the reversing gear? The Fulcrum pin had been injured.
1790. *President.*] Could that be easily discovered? Yes.
1791. And easily remedied? Yes; it is only putting in a stronger pin, that is all.
1792. *Mr. Hoyle.*] Are there any engines in your district now? None since December.
1793. Why were they taken off? I do not know.
1794. Were any of the axles taken off at any time and trued up, and the axle-boxes repaired? Not to that extent. The only repairs were the one tender axle and the bogie axle, to be screwed up by the journal to spare fling.
1795. Did you bore out the axle-box as well? No.
1796. Did you find the axle-boxes in any of them wear into the wheel? In one they did, but it was very slight.
1797. Were you there long enough to observe this? Yes; I have been sufficiently long in my district to observe that. It was very slight, no more than would be on other engines.
1798. Do you say that on other engines the boxes of the wheels wear into the axle? Yes, in other engines they do just the same.
1799. *President.*] You say that in other engines the axle-box wears into the boss of the wheel just as in the case of the Baldwin engines? Yes.
1800. Then is there nothing exceptional in that? No.
1801. Then do you notice it in all of them—all classes of engines? Yes.
1802. In English engines for example? Yes; in all classes of engines you will find that they will more or less wear.
1803. Looking at these engines which are new and are just coming into use, and taking into consideration that

that they are powerful engines, did you find that more repairs to them were required than say to a powerful English engine? We have not had the experience of English engines of the same power or near the same power to enable us to make a comparison.

1804. Are these the most powerful engines that have been used in this Colony? To the best of my knowledge they are.

1805. Well, at the time they were used, were they the most powerful engines that had ever been at work here? Yes, I believe so.

1806. So you cannot compare the repairs necessary for them with those required for a similar class of English engine? No, sir.

1807. Can you tell us whether for new engines you consider that the repairs made were excessive? Well, there is always something to be done with new engines, the amount of repairs was fairly heavy.

1808. Was it in your opinion excessive, taking into consideration the size of the engines? No, I do not think so.

1809. *Professor Warren.*] You only speak of your own district? Yes, that is all.

1810. *President.*] Speaking of one wheel being smaller than another is that unusual? Well, I have not come across many instances, but it might easily have happened, it would be the fault of the wheel-turner.

1811. But I thought you said that it happened on other engines? Oh, yes; but not to the extent the tyres are concerned; I thought Mr. Hoyle referred to the axles.

1812. *Mr. Hoyle.*] Have you ever found the tire of one wheel larger than another in other engines, with the same axle for both wheels? Yes, slightly.

1813. Would such a thing have the effect of causing the wheels to run slightly on the skew? Very slightly. What I noticed was that they showed about a 32nd. a side; so taking the roads they have to run over it would make very little difference.

1814. Have you tried any of the others to see if they are the same? No, I have not, I have made no further examinations.

1815. *Professor Warren.*] You have said that the estimated difference of an eighth of an inch was due to the turner? I said a bare eighth.

1816. Well, would not that be rather unusual, even supposing it to be a sixteenth of an inch—would it not be unusual for a turner to make that mistake? Yes; but there have been mistakes of that kind made.

1817. You can feel the ten thousandth part of an inch, although you may not be able to express it; you would know whether it was under or over, and so one-sixteenth would be a big error? Yes; but it has been noticed so in other wheels turned out; the turner's gauge may not be accurate.

1818. *President.*] The difference is in the tyre? No; what we call the thread.

1819. *Mr. Brown.*] So far as these engines came under your observation, did they do their work satisfactorily? Yes; while under my observation.

1820. What work were they doing? Well, we were running Nos. 20 and 55 passenger trains between Sydney and Newcastle.

1821. And did they work satisfactorily while they were doing that—did you look on them as serviceable and suitable for the permanent way of New South Wales? Yes.

1822. How long were they employed in your district? From the middle of August to the latter part of December.

1823. And during that time did they give satisfaction? Yes; the engines I had to do with did so.

1824. Did they work well? Yes.

1825. And yet you cannot say why they were taken off the service despite the fact that they were doing their work well for about five months. They were taken off and you are not able to give any reason why? No; I cannot give any specific reason.

1826. *Mr. Hoyle.*] Can you give us the name of the turner who turned these wheels up? I could not give you the name just at this moment, but I could easily get it for you.

1827. Have you found any failures in the brake-gear? There were no failures in the brake-gear during the time they were under my charge.

1828. Was there only one axle broken whilst these engines were under your charge? The one tender axle only, I think.

1829. And this train that the axle broke in was from Sydney. It was in the Northern express service, I understand? Yes; I believe so.

1830. Do you remember that at the time the engines were running in your district whether any of the draw-hooks broke? Not during the time that they were under my charge.

Isaac Gregory, being sworn, said:—

1831. I am shed foreman at Penrith, and I have been in the railway service of New South Wales since 1877.

1832. *Mr. Hoyle.*] Have you been a driver, Mr. Gregory? Yes; I have.

1833. And you have had considerable experience in the service as a driver? Yes; I have had.

1834. Did you accompany a train that went from Sydney to the west in order to try the platforms, I mean the gauge of the platforms? Yes.

1835. Was there a gauge fitted to the engine of that train, made up to the width that would correspond with the width of the cylinder of the Baldwin engines? Yes.

1836. *President.*] Was that engine fitted up with a gauge to show the width of the Baldwin engine cylinder—was it fitted for that purpose? Yes; I think it was.

1837. I understand you do not really know what it was fitted for, but that you think it was fitted for this purpose? Yes.

1838. *Mr. Hoyle.*] Was that gauge put there to represent the width of the cylinders of the Baldwin engines? It might be the width that the cylinders of the Baldwin engines would be, but I am not certain, it was placed on the engine before I arrived in Sydney.

1839. How far did you go with that engine? I went from Sydney to Bourke.

1840. Did this gauge, fitted to the engine scrape some of the platforms as you passed? Yes; I think it did scrape some of them.

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W. Pilford.
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I. Gregory.
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1841. Then you were not told what that gauge was for? No; I was not told what it was for.
1842. Did it correspond with the width of the Baldwin engine? Yes; I think it did.
1843. You say it scraped some of the platforms? Yes, one or two; I am not quite sure how many.
1844. *President.*] Where? I am not quite sure of the stations, although I took the measurement at the time, there were Sydney and Granville; at Granville it just touched in one place, whilst the engine was oscillating in going through the platform.
1845. *Mr. Hoyle.*] Did you measure all the platforms as you passed? Yes.
1846. And did you report to the officers of your Department the result of that trial trip? Yes.
1847. Is that report containing your measurements still in existence? I do not know, but I suppose so.
1848. I would like that report to be put in.
1849. *Mr. Fehon.*] If the reports are in existence, they will be put in.
1850. *Mr. Hoyle.*] I think the Commission should insist upon them being produced? The witness says he made a report, and sent it to the Department.
1851. *President.*] Mr. Fehon says if reports of these measurements are in existence they will be put in. I think that should be sufficient, Mr. Hoyle.
1852. *Mr. Hoyle* (to witness).] You made a trial of the platforms on both sides of the line, I suppose? Yes.
1853. In any place where the engine struck would it be possible for the Baldwin engine to pass going at anything like a high rate of speed without touching the platform? They might strike by oscillation.
1854. But where this engine scraped they would pass? Yes, I suppose so.
1855. Therefore the platforms would have to be chipped away to allow the engines to pass, is not that so? Yes, to permit them to pass freely, perhaps.
1856. *President.*] Do I understand that the engine could not get by, or was it oscillation? A certain amount of oscillation would cause the engines to touch.
1857. *Mr. Hoyle.*] Did you notice any other places where the gauge touched besides the platforms examined? No.
1858. Or places where it was rather close but did not quite touch? Yes; I noticed some places where it was rather close.
1859. And all these cases are in your report? Yes.
1860. Have you anything to do with ordering the engines out to do work? Yes, to supply the demands of the traffic.
1861. Since the Baldwin passenger engines have been out have they been ever run with the mail at night; I mean, since you have been there, did they ever require a tail engine or push-up-behind engine? No, except in very bad weather, or with an exceptionally heavy load.
1862. What is the usual passenger train? There are usually sixteen and a-half carriages to a passenger engine.
1863. Does she take it up without any other assistance? Yes, except, as I have said, in very bad weather.
1864. *President.*] Will you explain—I do not quite understand what these sixteen and a-half carriages represent? I will explain, sir; the old count was up to 10 tons for one carriage.
1865. *Mr. Fehon.*] It is in this way, sir; it varies according to the class of carriage; it is all based upon the old four-wheeled carriage; a large carriage represents one and a-half carriages, a still larger carriage represents what is known as two carriages, and so on; so that sixteen and a-half carriages may mean practically four large carriages.
1866. *Professor Warren.*] What does that mean in weight?
1867. *Mr. Fehon.*] There are 10 tons to each carriage, so that counting each carriage up to 10 tons, a carriage representing 20 tons would represent under our system two carriages, although as a matter of fact it would only be one carriage.
1868. *Mr. Brown.*] Then the total weight for a passenger train would be 165 tons?
1869. *Mr. Fehon.*] Yes.
1870. *Mr. Hoyle* (to witness).] You say you only had a pilot engine when the load exceeded that amount, or in bad weather? Yes.
1871. Do these engines ever slip? I never heard of them slipping.
1872. Did you ever hear a report from any of the drivers that there was an engine behind time for an hour through slipping; about, I think it was, the 4th April the occasion I refer to? I do not know.
1873. *President.*] Do you mean the 4th April this year?
1874. *Mr. Hoyle.*] Yes, about that date. [To witness.] Do you know if any of the other trains have had to drop their load in order that the Baldwin engine might bring it on? Yes; I think it was on the 14th the train had to drop its load and give it up to the Baldwin engine.
1875. You also remember that? Yes.
1876. And then had to run in light? Yes.
1877. It ran in without a load? Yes; the first engine gave the load up as it was not able to take it on, and the Baldwin engine came along with the second train and the carriages were taken off the first engine and put on the second one, this was from Lawson to Katoomba.
1878. *Professor Warren.*] You pass over a heavy grade there? Yes.
1879. So that this engine took about 185 tons over a heavy grade? Yes.
1880. *Mr. Hoyle.*] Do you know of any case where any portion of a load has been dropped when the other engine was able to pull it? No.
1881. Does the Baldwin engine run from Penrith to Katoomba going back light.—the Consolidation engine, say? Yes; the Consolidation does come back light from Katoomba, after taking a mail up.
1882. *Professor Warren.*] You are speaking of the recently imported engine I presume? Yes; the 8-wheeled couple—as we call them.
1883. *Mr. Hoyle.*] Why does not the Consolidation engine, instead of coming back without any load to Penrith, take a load on to Bathurst? Well, it is not adapted for taking trains on.
1884. Why; on account of the speed? Well, it may give the speed, but it is not built for that grade, it is not intended for such purposes.
1885. Would it have an effect upon the permanent way if the Consolidation engine ran the return trip between Katoomba and Bathurst, to time? Well, it might be done.
1886. *Mr. Fehon.*] Will you allow me to explain sir. These engines are intended for running the mountain traffic; they are not intended for running at a high rate of speed. It would knock the road about if they were run at a high rate of speed; they are not intended for that purpose, and they are not being used for it.

1887. *President.*] Our Commission says that we are to inquire whether these engines are unsuitable to the permanent way of our railways; therefore, I think Mr. Hoyle has a right to put these questions, if he wishes to do so; but you can explain afterwards that these engines were not intended for such service, and would not be put to it.

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1888. *Mr. Fehon.*] I thought a wrong impression would get abroad, and, therefore, I wish to explain that these engines were intended for a heavy grade and not for anything else, not for running at a high rate of speed.

1889. *Mr. Hoyle* (to witness).] Do the passenger Baldwin engines take the mail on to Katoomba? Yes.

1890. Have you had much experience of these engines? Not on the engines.

1891. But about the repairs? No, I have not much to do with repairs, only to see that they are completed in a proper time, so that the engine may go out at a proper time.

1892. Do you know of any draw-hooks breaking? They may have broken, but not in my presence.

1893. Do you know anything about draw-hooks or coupling-chains breaking on trucks drawn by these engines? I do not know from my own knowledge, but I think there have been several broken.

1894. Has it been the links or the hooks that have broken? The hooks, I think.

1895. Who would know all about that? I suppose the foreman-fitter would know.

1896. Is it part of the guard's duty to report these things? Yes, he reports them to his superior officer (the District Superintendent, Mr. Duff).

1897. Since these trains have been running, what load do they put on; what number of loaded trucks is put on either the Consolidation goods engine or the passenger engine when she has to haul a goods train? A passenger engine takes twenty trucks and a large brake, and if that weight of trucks is exceeded there is second engine to push up.

1898. And you put that on for safety? It is always done up the mountains. It is very seldom they run a single train up the mountains now.

1899. Is it ever done with less than twenty or with twenty? Not that I know of. The train is held with the assistance of a heavy brake behind.

1900. What is the weight of these trains, supposing you had twenty loaded trucks? Well, there are about 10 tons in each truck when loaded, and the brake van would be about 19 tons.

1901. *President.*] That is about 219 tons in all.

1902. *Professor Warren.*] Do you mean to say that the Baldwin Consolidation engine can pull 219 tons? Well, she takes 22 trucks up the grade.

1903. *Mr. Hoyle.*] And do you think that in taking up that enormous load the draw-gear is not in any way endangered? Well; not at present, I think.

1904. Suppose I take this pencil and pull it to-day, I may strain it a little, and if I pull it to-morrow there is a likelihood of a greater strain, and the time may come when, with the maximum strain, it might break altogether; would not this be the case with the draw-gear, would it not be sufficient to break it in time?

1905. *Professor Warren.*] I do not think you ought to ask this question. It is a very difficult one; you mean, will the maximum pull on the train stretch the hooks beyond their elastic limits, I think that would be better ascertained in the testing machine.

1906. *Mr. Fehon.*] Perhaps the most practical way would be to ask him if he knows of any accident that has happened to the draw-gear; but, as to his opinion, it was a question what it was worth; it might be worth a great deal or it might be worth very little.

1907. *Mr. Hoyle.*] I was never a guard on the railway line, and so far as breaking away is concerned I can only go by my knowledge gained through the reports that are found in the press; I only know that trucks did break away through the gear breaking at Bathurst where loss of life happened through this cause.

1908. *President.*] You mean to show, I suppose, that presuming there is a constant strain every day upon this gear it will so weaken it, that one day it will break, and a smash will follow. Well, I think, with Professor Warren that this is a question which will be better decided in the testing machines; and again, you have to ask yourself is this a person from whom you should ask such a question. His opinion may be worth a great deal on the one hand, as pointed out, or on the other hand it may be worth very little.

1909. *Mr. Brown.*] Perhaps it is the inevitable end of all draw-gear.

1910. *Mr. Fehon.*] I cannot allow statements like the one Mr. Hoyle has made to go forth without informing you that when the Commissioners took office they found the draw-gear was inadequate to the strain put on it, and since we have been in office we have altered the whole of the draw-gear of the goods traffic, and the light draw-gear on the whole stock has been brought up to the standard of the heaviest draw-gear in the world. In order to provide against any probability of the trucks breaking away, all our rolling stock was fitted with the heaviest draw-gear that could be found in any part of the world.

1911. *Mr. Hoyle.*] I am quite aware of that, and I know that even the heaviest draw-gear has been broken, and that with a load not so heavy as has been put on these engines.

1912. *President.*] But in this case was the load unduly heavy; because, if so, an accident might happen at any time, even though the Commissioners got the heaviest draw-gear in the world.

1913. *Mr. Fehon.*] I have a return of all the broken draw-gear or hooks, and I know the cause of their breaking, and I have the names of the men who were driving the engines at the time. Some of these breakages may be the result of bad welding or a flaw, but the greater number of them arise from the jerk received at starting or pulling up the steep grades. At starting, the engine may go away with a jerk, and the draw-gear may snap. We have provided against this to the utmost in our power, and we can do no more. Such accidents may happen under the best regulations with bad drivers.

1914. *Professor Warren* (to witness).] I understand you to say that the heaviest load the Consolidation engine can take up the Mountains was 220 tons;—is that the utmost load they can take? I did not say that was the utmost. For a short distance they might do more.

1915. Would you put more than that on the engine? Yes; I might; but I think that is a fair load.

1916. Well, supposing the maximum to be 220 tons, it is an easy thing to decide whether the draw-gear might easily be broken or would be sufficient for the load.

1917. *Mr. Fehon.*] Mr. Thow, the Chief Mechanical Engineer, will be called by the Railway Commissioners to give all this evidence.

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1918. *Professor Warren.*] Yes; but since the matter has arisen I am bound to satisfy myself that it will take that load. It means simply that you ought to supply the drawings of the draw-gear for the engines and the trucks—the one as between the engine and the train, and the other the ordinary draw-gear between the trucks. Will you try and have that put in.

1919. *Mr. Fehon.*] I submit that, as the draw-gear between the trucks, that would be going into a general inquiry with regard to the rolling stock of the railways.

1920. *Professor Warren.*] It has been decided, I understand, that we must take some notice of the trucks.

1921. *Mr. Fehon.*] I admit that a mistake was originally made with regard to the draw-gear, but heavier hooks have since been substituted at the expense of the Baldwin Company. That deals entirely with the question of the draw-gear supplied by the Baldwin Engine Company. As to what may be behind those engines—as, for example, the draw-gear between the trucks—that, I submit, has nothing to do with this inquiry. It might be the coupling of other engines nearly up to the capacity of these; so that, in fact, if this question were admitted it would resolve itself into an inquiry into the condition of the rolling stock generally of the Colonies.

1922. *Professor Warren.*] Well, will you supply drawings of the strong draw-gear you used on the Baldwin engines.

1923. *Mr. Brown* (to witness).] Does the strong gear with the load you now put to the engine give satisfaction? Yes.

1924. Do you know of any cases of its giving way? No.

1925. You know that other draw-gear was substituted for that originally used? Yes.

1926. *President.*] You have never known this new draw-gear to give way? No.

1927. *Mr. Hoyle.*] You say you have heard of some links breaking attached to some of the trucks? Yes; I have seen all kinds break, strong and standard, but it has been chiefly in starting the train where the brakes have been put down, about Katoomba principally, and thereabouts. Putting down the brake suddenly throws a strain on the hooks.

1928. Did you ever at any other time accompany the officers in other trials to test the width on the other stations? No.

1929. It was only on the Western Line? Yes.

Henry Robinson being sworn, saith:—

Mr. H.
Robinson.
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1930. I am connected with Mr. Stangar's staff, Department of the Locomotive Superintendent.

1931. *President.*] How long have you been in the railway service? About nine years altogether.

1932. What is your exact position, how would you define it? I am with Mr. Stangar's staff, and inquire into little matters in connection with the running of the trains.

1933. *Professor Warren.*] You are assistant to Mr. Stangar then I understand? No; I am connected with his staff, that is to say, I am on his staff.

1934. *Mr. Fehon.*] Mr. Robinson was a cadet in the Department, coming to us from school, and when his time was up, he took a trip through Europe and America, and since coming out he has been placed in Mr. Stangar's office to make inquiry into matters coming under his notice that necessitate inquiry.

1935. *President.*] Was he sent Home from the Department?

1936. *Mr. Fehon.*] No. He was one of those who went Home at his own expense, prior to the cadets being sent by the Commissioners.

1937. *President.*] Did you make any inquiries into the working of railways when you were at Home? I went Home to make inquiries, and to try and pick up as much information as I could. I visited several establishments at Home.

1938. And I suppose you picked up some experience? Yes; some little experience.

1939. *Mr. Hoyle.*] Did you make any tests or trials of coal stages, or the platforms in connection with the Baldwin engines? I cannot say that I personally made any tests, but I was present when one of the engines was being run over the Northern Line.

1940. Where was that? The Northern Main Line.

1941. Was there any gauge on that engine that would make up for the width of the cylinders of the Baldwin engines? No.

1942. You had no gauge at all? There was no gauge at all.

1943. On what engine were you? I was on one of the Baldwin engines.

1944. Where did you go to? We went as far as Wallangarra, near the Queensland Border.

1945. Did you find that anywhere that any of the cylinders scraped, or went very close to the platforms? No; not in one instance.

1946. Was there plenty of room for these engines to pass going at a high rate of speed? Well, quite sufficient room to allow the engine to pass and to allow for oscillation.

1947. You went the whole length of the Northern Line, did you not? Yes. Wallangarra is the extreme point in our Colony. But I am speaking principally now of the distance from Strathfield to Wallangarra.

1948. That is practically the whole distance? Yes, we have a branch line from Werris Creek.

1949. Oh, I do not refer to that, your trip was on the Main Northern Line, was it not? Yes.

1950. Did the cab of the engine, during any part of your trip, come into contact with the verandahs of any of the platforms? No, I cannot say that it fouled any of them.

1951. Were any alterations made to any of the platforms in consequence of its coming into contact with them? I cannot say.

1952. *Mr. Brown.*] Were you watching throughout, and are you speaking of your own knowledge when you say it did not touch any of these verandahs or platforms? I say it did not foul any of them.

1953. Did it not hit any of them? No.

1954. Did it not knock any portion away? No, not that I am aware of. I am speaking of the Northern Line.

1955. Had any of the Baldwin engines gone over these lines previously? Not that I am aware of.

1956. Then that was the first one? Yes.

1957. Did you know subsequently of any of the Baldwin engines striking any of the platforms? No.

1958. Did you know of any of the Baldwin engines striking any of the verandahs between here and Newcastle? No, I did not.

1959.

Mr.
H. Robinson.
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1959. *President* (to Mr. Hoyle).] Would you contend that because these engines did touch the verandahs or platforms they would, therefore, be unsuitable for the permanent way of the colonies or defective? No; but I would say that it showed gross negligence on the part of the officers in not seeing that these details were attended to in the specifications they sent to America for these engines.
1960. But suppose that an engine was a good one, and it was built up a little too high, so that a verandah would be injured, would you in that case say that the engine was defective or unsuitable to the permanent way, just because the Commissioners might have to remove a portion of a platform or two? No; but I think it would show great want of care on the part of the officers, and one of my charges is that there was neglect on the part of the officers.
1961. You contend that before they allow the engine to go they should have seen that it cleared all the platforms? Yes; that before the specifications were drawn up this should have been seen to, so that we should not have had to alter any of our platforms to allow these engines to pass.
1962. *Mr. Hoyle* (to witness).] Did you make any reports in connection with the coal stages? No; I made no report whatever.
1963. Was there not any investigation made relative to the coal stages in connection with these engines? Not that I am aware of.
1964. Were any alterations made at any of these stages to meet the convenience of these engines? I cannot say whether there was any alteration made or not, but I daresay the line was altered a few inches perhaps.
1965. Had that anything to do with the width of the cylinders of the Baldwin engines? I do not know why it was altered at all.
1966. Do you know if the coal stage at Eveleigh was altered in connection with these engines or not? I do not.
1967. Were any alterations made to the coal stages in connection with these engines? There was a deviation made in the line, but whether in connection with the American engines I do not know.
1968. Was it made before or after they came? I cannot speak except from memory, but I believe it was made before the engines came or about the time they came.
1969. Did I understand you to say that you only went on the Northern Lines on these trials, did you go on the South Coast Line or on the Western Line making a similar trial there? Yes, I went on to the Southern Line.
1970. Did you go to Picton on the Southern Line with an engine? Yes.
1971. Could you go past Picton platform before the rails were shifted, I mean the line was altered? No.
1972. You could not? No.
1973. You could not pass Picton platform with the Baldwin engine until the rails were slewed or the platform altered? Oh, we got past the station certainly, but the lines were afterwards altered I believe.
1974. But the cylinder touched? No, it went very close.
1975. Could the engine have passed with safety running at the rate of say 30 miles an hour? I daresay if all the brasses were in good condition, in that event we might have got through safely.
1976. *Mr. Brown*.] Would you like to be on an engine going at the rate of 30 miles an hour, and to have it pass so close to the platform as you say this pass. Would you have liked to have driven an engine through at that rate? Yes; I dare say I could have driven the engine.
1977. Do you think it would have derailed the engine? No; perhaps it might have scraped the buffer beam, that is all.
1978. Did you find you got very close to other platforms on the Southern Line? It is some time since I went on the trip, so that I cannot remember quite clearly.
1979. Did you make any report on your trip? Yes.
1980. Did it contain the measurements of all the distances? I do not remember if all the distances were given, because in the majority of cases the engines cleared very well.
1981. But in the cases where the engines did not pass the stations very well, where, in fact, they went too close, did you report on the distances? Yes.
1982. Was that report made by you? I do not know if my figures were sent in; figures may have been sent in by the engineer.
1983. You made a report, at any rate; you made these measurements? Yes.
1984. Did you make a press copy of your own report, or keep a copy of any kind; is it in existence? Yes; but I do not know if I could lay my hand upon it or not.
1985. Is it not in the books of the Department? I cannot say.
1986. Did you not take a copy of it in your own private book, or one of the books of the Department? I cannot say. I copy so many letters that it is impossible for me to remember each particular one.
1987. You mean in your own Department? Yes.
1988. *Mr. Hoyle*.] I ask that that report be put in.
1989. *Mr. Brown*.] He says he cannot remember if he has got it or not.
1990. *President*.] Have you got it, Mr. Fehon?
1991. *Mr. Fehon*.] It may be in existence—we shall try to find it.
1992. *Mr. Brown*.] Let him look through his books, and if he can find it, let him produce it.
1993. *President*.] Yes, if he can find a press copy let him produce it.
1994. *Mr. Hoyle*.] At what speed were you going when you passed the Picton platform? We generally slow up when going past platforms.
1995. About what speed were you going? Well, that all depends upon what speed you come up at, whether the signals are against you or not, if you have a clear line, and so on.
1996. But for the purpose of making this test, and ascertaining these measurements, at what speed were you going along? I could not say.
1997. At Picton, were you going at a pace of about 4 miles an hour? Yes.
1998. Did you get very close to the Guildford platform? No; I think we had sufficient space at the Guildford platform.
1999. Did you get very close to Merrylands platform? I cannot remember the individual platforms as we went along.
2000. Do you say you cannot remember the various platforms you passed, and where you found the engines very close? Picton is the only one I can remember.

- Mr. H. Robinson. 2001. Did you go on the South Coast line? No.
- 21 April, 1892. 2002. The Northern and the Southern lines were the only ones you went on? Yes; and the Western line also.
2003. What did you find on the Western, was it on a Baldwin engine that you went? Yes.
2004. Did you come into close contact with any of the platforms on that line? No; we got through with a sufficient amount of clearance.
2005. Was the clearance in all cases sufficient to allow the engine to go through at the speed a passenger engine would have to run at? I cannot say that, I do not know.
2006. *Mr. Brown.*] We have it already in evidence that about £2,000 to £3,000 was spent. The Commissioners are best qualified to judge whether it was wisely spent or not.
2007. *Mr. Hoyle.*] I am only asking this witness now whether these engines went so close to the platform as to touch, or whether they were able to pass them safely. I am not asking these questions for any purpose of delaying.
2008. *Mr. Brown.*] Upwards of £3,000 were spent, and the bulk of that sum was expended shortly after the Baldwin engines arrived, and the Commission will have to determine whether it was spent in connection with the Baldwin engines themselves, or whether it was spent in order to secure uniformity of gauge as the Railway Commissioners allege.
2009. *Mr. Hoyle.*] All I am trying to do is to put anything before the Commission that I can put on this particular point, in order to show that there was some neglect on the part of the officers in this matter.
- 2010.] *President.*] Supposing the engine had run close, does that show that these engines are defective and unsuitable for the permanent-way of the Colony, and that they are not performing the services that are expected of them. Do you want to make out that it was negligence to run so close to the platform. If a platform were in existence which would be so close to the engine when it passes that might be evidence of negligence, if some accident happened in consequence of it, but how does that bear on the question we are trying? We are not trying whether the Department generally is guilty of negligence, but whether the negligence they have shown is in importing engines to the Colony which are defective and unsuitable to the permanent-way of the Colony, and not doing the work that is expected from them.
2011. *Mr. Brown.*] Do you wish to show that some official had been guilty of some negligence in this matter?
2012. *Mr. Hoyle.*] I make no charges against the Railway Commissioners; but I say that someone was guilty of neglect in not ascertaining these facts with regard to the platforms before the engines were ordered, and adapting the specifications to them. With regard to the extent of this inquiry, as laid down in the Commission, I certainly am not aware that anyone ever alleged that these engines were not performing what was expected from them, I never said so.
2013. *President.*] The words of the Commission are as follows [*Commission Read*]. These are the three things we have to inquire into, and how does the evidence you are now bringing out bear upon them.
2014. *Mr. Hoyle.*] But it bears upon the alteration of the platforms. When Mr. Eddy came here at the first meeting of the Commission you asked for someone to come forward and make direct charges. I came forward, and I have made these charges. The Royal instrument may say something perhaps, and include in that some things that have never been alleged against the engines, yet surely my charges will have to form some considerable portion of what you will have to decide in determining this question.
2015. *President.*] You cannot come and make charges outside this Commission, but you are allowed to state in support of one of the charges that a great many of the platforms were altered because the Baldwin engines had been imported. It might be that this would show that these engines were unsuitable to the permanent-way of the Colony. A vast expense having been incurred to alter the platforms on account of the importation of these engines might go to show that they were unsuitable to the permanent-way. In other words looking at what our platforms were, if they were to be regarded as permanent-platforms and a vast expense had been gone to in altering them, if they had had to knock them down or remove them in order to fit these engines that would be some evidence that the engines should never have been brought here, that is looking at the difference between the width required for them and the measurement of our platforms and stations along the line. But unless you are prepared to show that it was some vast expense that reasonable people would not go to, I do not see how that will help your case. Were a few bricks taken, some coping-stones removed, parts of verandahs cut down, that a much more serviceable engine could be used on our lines, would that show that these engines were unsuitable to the permanent-way?
2016. *Mr. Hoyle.*] The platforms are part of the permanent-way.
2017. *President.*] Only relatively so; that is to say, platforms built in some very substantial and solid way—so substantial, in fact, that it would be an outrage to interfere with them unless with very good reason—might be regarded as part of the permanent-way; that is to say, if they were built at an enormous expense and very substantially, and yet had to be pulled down or partially destroyed in order to let these engines pass, that might be evidence that the engines were not suitable for our permanent-way. All these things must be relative. But, on the other hand, if by chipping away a little brickwork you will enable an engine to be brought here that will be able to do a great deal more work than any engine did before, then you must look upon the matter as a question of the relative benefits or otherwise that follow.
2018. *Mr. Fehon.*] In America the permanent-way is complete without a platform.
2019. *Professor Warren.*] I must ask for some information as to the platforms, the alteration of the gauge, width of platforms, &c.;—can I have it?
2020. *Mr. Fehon.*] It is being prepared.
2021. *Professor Warren.*] It seems to me that when we get that information all Mr. Hoyle's questions with regard to these platforms will be answered.
2022. *Mr. Brown.*] I think that what Mr. Hoyle desires to show is, that since we knew that this large sum of money had been spent, it was for the Commission to determine whether it was spent in connection with the Baldwin Engine Company, and whether, under all circumstances, it was a justifiable expenditure in connection with the Railway Department. Knowing the value these engines were likely to prove, still was it worth while to interfere with the platforms, thus causing additional expense in connection with these engines.
2023. *President* (to Mr. Hoyle.) So far as I am concerned, I wish to give you every latitude, but I cannot

see how these questions bear upon the matter. It may be said the cab of the engine touches the verandahs, but how does this show these engines are unfit for the permanent-way.

2024. *Mr. Brown.*] Should you not show, Mr. Hoyle, that these plans or specifications should have gone to some particular part of the Department, and should have had the sanction of the officers there before they were sent forward when the engine was decided upon, should you not have shown the plans of the engine and submitted them to the Head of the permanent-way, saying: Now these are the engines we propose to send for—are they suitable to the permanent-way?

2025. *Mr. Fehon.*] The gauge was sent to the Baldwin people and they knew what was required, but the verandahs and platforms were not always to gauge; but that was not the fault of the Baldwin Company. Mr. Hoyle is trying to question this witness on the trial-trip to test whether these engines were right or not; surely the Commissioners would have done very wrong if they had started the trains without making such a trial trip.

2026. *President.*] If you had been satisfied that the platforms were in gauge you would do it.

2027. *Mr. Fehon.*] Yes.

2028. *Mr. Brown.*] Would you not ordinarily have transmitted these plans and specifications to the various Heads of the Departments whose works they may concern? I am not saying, you will understand, that you were not quite right in sending up the engine along the line; but could you not have ascertained before the specifications for these engines were sent whether they were suitable for the permanent-way or not, by submitting that question to the proper officer?

2029. *Mr. Fehon.*] All that will come out in our evidence. These engines were a necessity at the time. We had other engines ordered in England at the time, but the manufacturers could not supply us with them in time for the last wool season, and therefore, as a matter of fact, we had to fall back upon the manufacturers from whom we could get the engines sufficiently speedily to meet our circumstances. That was the reason why we ordered them. We knew in ordering the Baldwin engines what they were. It was like asking for a Waltham watch—we had not to inquire what the mainspring was made of, and so on. The Baldwin people are people of very great repute, and if you order ten or a dozen engines it is nothing to them. They have a very large extensive business, and they would not sacrifice their good name in order to supply us with defective engines. All this will come out in the evidence we shall give.

2030. *Mr. Brown.*] You will understand we do not wish to limit you, Mr. Hoyle, in any way; but you have heard the matters the Commission requires us to inquire into.

2031. *Mr. Hoyle.*] I can see now there is something in the Royal Instrument which is outside any charge that anyone has ever made against these engines. It has been put in without any necessity, and it covers the Railway Commissioners clean up.

2032. *President.*] If there is no necessity for it then it only makes the inquiry larger. What, I repeat, we have to inquire into is whether these engines are defective or are unsuitable to the permanent-way of the Colony, or have not done the work that was expected from them.

2033. *Mr. Hoyle.*] I say that charge was never made.

2034. *President.*] Therefore we are only required, you think, to inquire whether they are unsuitable to the permanent-way or defective? I really do not see how it affects this matter, simply because in passing this engine may have touched some of the platforms, unless you can show that these stations were made of granite or some solid material, and were, in short, of such a substantial nature that they could be regarded as part of the permanent-way.

2035. *Mr. Brown.*] You cannot complain of any want of range in this Commission, Mr. Hoyle.

2036. *Mr. Hoyle.*] I have had the fullest fair play so far as this Commission is concerned. It seems that an order has been sent to America for these engines without the slightest regard having been taken in regard to the risk to human life or the property that might be behind them.

2037. *President.*] You ought, as a public man, to remember that the press and public are admitted here, and you yourself know that if these statements go forth to the public, without the Commissioners on their side coming forward, it may cause the public to be frightened, and convey a wrong impression. I should feel sorry that we had allowed any one to be present if these charges are to be made. You must not make charges that will frighten people until at least you have heard all the evidence. We do not care about the Railway Commissioners any more than we care about anyone else in this inquiry; but if we think our report should be favourable to the Baldwin engines we shall give it in that direction; or if we find that the Baldwin engines are defective, we shall bring in a report accordingly.

2038. *Mr. Hoyle.*] I have no further questions to ask the witness if he has not been down the South Coast Line.

Charles Baggs, being sworn, said:—

2039. I am Sub-Inspector of the Locomotive Department, and am stationed at Eskbank.

2040. *President.*] How long have you been in the service of the Department? About 23 years.

2041. *Mr. Hoyle.*] Did you have much experience with these Baldwin engines at Eskbank? Well, they passed through there; there are none stationed at Eskbank.

2042. Do you remember whether on Friday last there was an accident to one of these engines on the Mountains? I do not remember any accident to them.

2043. Did any of them break down excentric strap? Yes, I believe so, but it was not at Eskbank.

2044. Was any telegram sent to you about the matter? No telegram was sent to me to "Send another engine on."

2045. *Mr. Brown.*] He does not know personally that this accident happened.

2046. *Mr. Hoyle.*] A witness stated yesterday that an excentric strap had broken in one of these engines, and I was told that an engine was telegraphed for.

2047. *Mr. Hoyle.*] Was there any stoppage of the traffic between Eskbank and Penrith? Yes, through an engine getting disabled.

2048. Do you know what happened to that engine? Not personally; there was nothing sent to me about it.

2049. How then do you know it was disabled? Only by hearsay.

2050. *President.*] I suppose a telegram was sent along the line? No telegram was sent to me.

2051. *Mr. Hoyle.*] Do you know whether at any time the brake-gear failed in any of these engines, about Lithgow or Eskbank; have any trains been detained on that account? No trains have been delayed by breaking

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- breaking of brake-gear at Eskbank; engines have come into the station with defective brake-gear, and we have repaired them. They only bring the train as far as Eskbank, and the accident would be repaired by the time the train was starting again. There was a lever broke one day belonging to the tender; that, I think, was about the greatest defect that has occurred to the brake-gear.
2052. You say you do not know of any train being delayed at Eskbank by the failure of the brake-gear or reversing-gear? There has been a delay on account of the reversing-gear; the train was delayed until we got another engine.
2053. You had to take one engine off and put another on? Yes, there was a delay of about 37 minutes to a mail train.
2054. When was that? On the 1st April, I think.
2055. Do you know the number of the engine? On the 1st April, it was 450.
2056. Do you know of any other failure in any part of these engines which came under your personal knowledge? No.
2057. Did none of the axles ever go wrong at Eskbank? Yes; we have had the tender bearings hot, that is all.
2058. Have you had them running hot lately? No, not lately.
2059. How long ago? About two months ago.
2060. Not since? No.
2061. Have you had any trouble with the bogie wheels? No.
2062. No trouble at all? None.
2063. Or with any of the other wheels. Have you detected anything wrong about the other wheels at all? No.
2064. Have you examined these wheels and found any defects in them? No.
2065. And what appeared to be blow holes in the cast iron? No.
2066. What you ordinarily know as blow holes in the cast-iron, have you not found any defects of that kind in them? No.
2067. Have you examined them minutely? Not very minutely, because the engines have not been stationed at Eskbank.
2068. *Mr. Brown.*] Are these engines giving satisfaction in the work they are doing, so far as they have come under your observation? I think they are.
2069. *President.*] Who is the next witness?
2070. *Mr. Hoyle.*] I do not think I can call any. I wanted to call the Engineer-in-Chief, but Professor Warren wants some documents from him, so, in the absence of these papers, I would rather not call him.
2071. *Mr. Brown.*] You can examine him so far, but if you do not want to call him now, of course we are satisfied, Mr. Hoyle.
2072. *Mr. Hoyle.*] Well, I will go on if he can be found.

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Mr. Henry Deane, being sworn, said:—

2073. I am Engineer-in-Chief for Railway Construction.
2074. *President.*] How many years experience have you had in regard to the railways of this Colony? My experience dates from the year 1867; since then I have had railway experience off and on; I have had over 12 years of it in this Colony alone.
2075. And before that where were you? In London and in Hungary chiefly.
2076. *Mr. Hoyle.*] Did your Department prepare the plans for the construction of the South Coast Railway, Mr. Deane? Yes.
2077. That line, I presume, was carried out under the supervision of your officers? Yes.
2078. Were the platforms and stations on that line made to the standard gauge of the Department? I believe so.
2079. But I presume that the gentlemen in charge of it would have direct instructions, and that your plans would show that these stations ought to be erected to gauge? Yes.
2080. Do you know if any of these platforms, upon the completion of the line, were out of gauge? I am not aware of it.
2081. Had your Inspectors to pass this work before the contractors were paid? Yes.
2082. Would it be part of his duty to examine these platforms, to see that the work had been carried out according to plans? Certainly.
2083. And did your officers report to you that everything was all right—that the platforms and stations were according to plans? They did not report to me because I was not Engineer-in-Chief at that time. Mr. Whitton was Engineer-in-Chief.
2084. But they reported to Mr. Whitton, you say: Are the reports in your office now? Not on that subject specially that I know of.
2085. Were any reports made when the work was taken over by the Inspectors? Before the works were taken over an inspection was made by the Engineer-in-Chief.
2086. Just so, and that was Mr. Whitton? Yes.
2087. Have you any reason to believe that these platforms on the Illawarra line were not to gauge—that they were not made according to the plans? I have no information on the subject. They were presumably to gauge.
2088. The whole of the platforms on the line? All that were constructed by the Railway Construction Branch.
2089. Just so. But you had nothing to do with the plans in connection with the duplication work on the Southern Line from Granville to Campbelltown? No.
2090. Had you anything to do with the construction of the duplication from Parramatta to Penrith? No.
2091. Your Department had nothing to do with that? No.
2092. But you had to do, of course, with the South Coast and North Coast lines? Yes. You mean by the North Coast Line the connecting line between Sydney and Newcastle?
2093. Yes. Can you tell me whether the structures on that line are the structures that were erected when the line was made. That is the permanent structures I mean, I am not referring to wooden platforms that may have been erected since, but I mean the permanent station buildings, were they constructed when you made the line? Some of them were.
2094. Such as Ryde, for instance? Ryde and Eastwood, and Hornsby were erected then. Carlingford is a new station.

2095. Have you any reason to believe they were not to gauge? No.

2096. I am asking you these questions, because it has been said that certain alterations were made to the platforms because they were not to gauge? Well, they were never reported to me as being out of gauge.

2097. Never reported to you as being out of gauge at all. Do you think that if they had been out of gauge—of course it is an important thing where an engine has to pass a platform that no part of the engine should come in contact with the structure—do you therefore think that if the platforms had been out of gauge, it would have been reported to you? If it had been found out before the line was handed over, it would have been reported as a matter of course.

2098. But have you ever heard until recently that the rails and platforms were out of gauge? Well, I always believed that the work constructed by the officers of my branch is very carefully carried out.

2099. That such work has been carried out according to plans? Yes, I always believed so.

2100. *Professor Warren.*] Was Mr. Firth the engineer of the Southern line? Yes.

2101. Mr. Firth has had a large experience, of course? Yes.

2102. You think it unlikely that a man of Mr. Firth's experience would make a mistake in a simple measurement such as that involved in the width of two platforms, or the width of the rails between two platforms? Well, as you mentioned Mr. Firth, I will tell you what did occur. He was living at Arncliffe, and I noticed that the platform there had been chipped away, so I asked him to measure them, and he measured them and found that they were exactly according to plans, but the explanation that I had afterwards was that the road was out of gauge, and that it had been found easier to chip the platforms than to alter the road. The road, however, to the best of my belief—Mr. Firth can say whether it was the case or not—was placed originally to gauge, but afterwards the rails may have been shifted by the permanent way men. Under those circumstances, rather than shift the road, which would have been a heavy and troublesome matter, they chipped a little off the platforms.

2103. *Mr. Hoyle.*] We will take an instance in which a platform stands on a curve—Otford platform. If your department left that platform to gauge, the curve I presume would be a true curve? Yes.

2104. If the line moved in towards the platform, in order to bring that curve back to its former position, I presume the line should be shifted back again so that the curve would remain its true radius? I do not think I quite understand.

2105. Take the Otford tunnel. The platform there is on a curve? Otford Station, you mean?

2106. Yes, the station stands on a curve—if the line moved in towards the station the true radius of the curve would be destroyed, I presume? Inappreciably.

2107. *President.*] Supposing the rails got moved in a little, that would destroy the trueness of the curve? It need not destroy it appreciably.

2108. Would it have been the right thing in regard to these stations to chip the platform or to put the rails in their proper position? Well, I should prefer to have the road in its proper position, but it is a question of cost to a large extent.

2109. What part of the inquiry does that tend to, even supposing the platform was chipped very wrongly?

2110. *Mr. Hoyle.*] Well, Mr. Foxlee stated that the Otford platform was out of gauge, and that by altering the rails they would destroy the curve.

2111. *President.*] Supposing that you even got these gentlemen to disagree upon what was the right thing to do what bearing has it upon the Baldwin engines—how can it show that they are unsuitable to the permanent way. One of two things has to occur either the road has to be shifted or the platform has to be chipped. How does either of these things show that the engines were unsuitable to the road, unless, as I put it before, the buildings were of such a kind as to be so absolutely mixed up with the permanent way, that you would have to look upon them as part of the permanent way. That is to say that they were permanent valuable structures. How does this bear upon the matter—whether the rail is shifted or the platform is chipped?

2112. *Mr. Hoyle.*] Do you consider, Mr. Deane, that the permanent station structures are part of the permanent way? No, the permanent way properly speaking includes rails, fastenings, sleepers, and ballast.

2113. *Mr. Fehon.*] In reference to the question put by Mr. Hoyle just now it would appear that Mr. Foxlee is at variance with Mr. Deane, but if you will refer to question 845 you will find that Mr. Foxlee was asked, "Have you any reason to believe that the rails had not really moved in towards the station," his reply being "I am not quite sure whether any alteration was made at Otford at all, but speaking generally, it is quite possible that where the rails were found too near the platform they had slewed from their original position, and in that case we should give them the necessary clearance by slewing them back."

2114. *Mr. Brown.*] Would it not be just as well for you to let Mr. Hoyle finish and then for you to contradict him afterwards?

2115. *Mr. Fehon.*] Certainly.

2116. *Mr. Hoyle* (to witness).] When you are constructing a line, do not you take into consideration the weight of the rolling stock that is going to run on it? You have to take into consideration the traffic that the line has to carry.

2117. Is there no rule which would guide you in that matter; for instance, are you guided in any way by the weight on the driving-wheels of engines? I think it is a matter for experience more than anything else. The heavier your permanent way is the more expensive it is, but the more durable it is. No one would think of running heavy locomotives over light rails. At the same time there is a certain amount of latitude allowable in the weight of the rails. I mean to say that you can run heavy locomotives like those recently imported by the Railway Commissioners over the existing rails, indeed, upon rails varying very considerably in weight.

2118. *Professor Warren.*] With perfect safety? With perfect safety.

2119. But not with economy? It would not be economical to run heavy rolling stock on very light rails, of course. If there is heavy traffic, the more material there is in the rails for wear, the greater the economy.

2120. *Mr. Hoyle.*] Do you think, Mr. Deane, that to run these engines of 92 tons weight at a high rate of speed over a 70-lb. iron rail is perfectly safe? I have not gone into that question.

2121. But do you think it is perfectly safe to run a 92-ton engine and tender upon them;—would it not have the effect of spreading the road or making it in some way unsafe? Oh, I should not think so.

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2122. We have 71-lb. rails now, have we not? Yes, but they are of steel.

2123. But we have a few 70-lb. iron rails, have we not? Yes; I think we have a few. I consider that the 71-lb. rails, screwed and spiked to the sleepers as they are, form a fairly steady road over which loads can be run at a high speed.

2124. And you do not think then that engines running at that speed with the driving-wheels weighted as those of the Baldwin engines are would tend to spread the road, or to make it in such a condition that extra expense would have to be incurred to keep them in good order? That is a matter that I have not considered very carefully.

2125. And you therefore are not at present prepared to give an opinion? I am not prepared to give an opinion.

2126. Have you any doubts about the matter at all? As to the suitability of the roads to carry these heavy loads?

2127. As to the suitability of the roads to carry these heavy loads at a high rate of speed? I believe it can be done with perfect safety.

2128. Also an engine of a greater weight—an engine weighing 97 tons—running, of course, at a low rate of speed, at a rate of speed not exceeding 18 miles an hour, can that also be run with perfect safety on our roads? Yes; I can understand the economy of putting heavier rails in, and it is very likely that if the question of the weight of rails was considered over again, and it was known that the heavy engines would have to be used, perhaps a heavier rail would be employed. It is more economical to use a heavy rail, but at the same time a 71-lb. steel rail can be used with perfect safety.

2129. But would the running of the heavy engines over a 71-lb. rail necessitate extra vigilance in keeping the road in repair. I believe that at present three or four men are employed to look after 13 miles of road, and I want to know whether it would require an extra number of men to keep that distance in a perfectly safe state of repair, and consequently entail greater cost upon the Department, if these heavy engines were run upon 71-lb. rails? The more the work done by the roads the more vigilance and care it would necessitate.

2130. The load is about 15 tons on the driving wheel? Yes.

2131. And you think that with that load on the driving-wheel extra vigilance should be shown in looking after the permanent way? I dare say; but I suppose that whatever is necessary is done. You see I am not connected with the permanent way. I do not know that I can give you any valuable information upon the subject, but I think that the common-sense answer is,—the more work the road has to do the more in the way of maintenance it requires. At the same time the difference may be inappreciable.

2132. But they may not be running more trains now than they did before;—what I want to get at is whether the heavier trains would have the effect that I have described? To some extent no doubt they would, but I do not know that there would be very much difference due to the few tons extra weight.

2133. Well, would they knock the road about more, do you think;—would these heavy engines be liable to knock the road about more? That depends principally upon the build of engine, because light engines may knock the road about more than heavy ones. I am not prepared to give any opinion on the subject as to the effect of any particular engine in use, because I have not gone into the question at all. I have not the information at hand to enable me to give any opinion upon it.

2134. But if you were called upon to-morrow to construct a line upon which it was intended to use these heavy Baldwin engines, would you recommend the construction of a line of 70-lb. rails, either for the sake of economy or for the sake of safety? I should think it perfectly safe to do so if there were not a large amount of traffic on the line. If it were a suburban line I should certainly adopt a heavier rail, as the Railway Commissioners have done.

2135. Would that be for reasons of safety? More for reasons of economy.

2136. But would not want of stability guide you in that case?

2137. *President.*] Want of stability as regards danger is one thing, and the witness has already said that there would be no danger whatever; but want of stability with a view to economy is another thing, and taking that into consideration, he tells you that he would use a heavier rail. He therefore answers your question.

2138. *Professor Warren.*] You would be guided by the traffic, I suppose? Yes.

2139. I thought of asking you some questions with regard to the stability of the bridges, but at that time I hoped to have the report of the Bridges Commission before me. I wanted to ask you how you thought the bridges would come out when loaded with these heavy engines. I am speaking now mostly from memory, but take the Solitary Creek Bridge for example, it is a 60-foot span, and, according to the inquiry, the tensile stress in the flanges was about $5\frac{1}{2}$ to 6 tons when loaded with the Consolidation engines, in fact, when loaded with $1\frac{1}{2}$ tons per foot run. These engines are 97 tons, and the weight on the driving-wheels is 15 tons. Do not you think it will be necessary to increase the strength of the cross girders by some means or other, and also the main girders, or to take some means to render such bridges capable of taking these heavy loads without being unduly strained? I may say that with regard to the older structures I had a conference with Mr. Foxlee as to the best way of strengthening them, but I cannot tell you at present what conclusions were arrived at with regard to the different bridges. I know, however, that at the time we considered the desirability of strengthening a number of them. It was proposed to strengthen them indirectly by putting a beam on the top so as to distribute the weight in a better manner.

2140. That was suggested by the Bridges Commission; I believe I have a very vivid recollection of that? Yes; it is a very natural suggestion to make.

2141. And with regard to the main girders, if I remember rightly, it was suggested that a third girder, might perhaps be put where the head room permitted in the middle of the road; at all events it really is proposed to strengthen the bridges which would be unduly stressed either by the Baldwin or the other engines? Yes; I believe that instructions have been given to Mr. Foxlee to prepare the necessary plans, and he told me only a short time ago that he was preparing them.

2142. If you take the wheel-base of the Consolidation engine, it amounts to 4 tons per foot run; the whole of that wheel-base could stand on a short-span bridge such as the timber viaducts;—do you not think that the timber viaducts and designs will have to be materially strengthened to carry these heavy loads? Yes; I have a new design for the timber viaducts that makes them very much stronger and better adapted to carry these heavy loads. Of course, with regard to older structures the factor of safety is reduced very much, and I do not know that anything can be done but to pull them down and build new ones.

2143.

2143. It is the short span-bridges I am inquiring particularly about? Yes; I do not anticipate any danger on the long-span bridge, because the load is distributed.

2144. That is all I think of at present, though probably when we have certain returns before us we shall call you again? If there is anything which requires mature consideration I should be very glad to know beforehand, that I might form an opinion which would really be of value. To give an opinion at a short notice is not always very easy.

2145. *President.*] You have seen these Baldwin engines? Yes.

2146. You know the loads that they can carry? Yes.

2147. Do you know the different parts of the lines that the engines go over at present; for instance, we hear that they are running on the mountains, also on the Southern line?

2148. *Mr. Fehon.*] No; there are none on the Southern line, but there are on the Western.

2149. *President* (to *Witness*).] You know, at all events, the parts of the Western line that these engines travel over? Yes.

2150. Are there any bridges which it would be dangerous for them to travel over? Yes; there is the Solitary Creek bridge.

2151. Where is that? It is on the Western line, between Tarana and Eskbank.

2152. *Professor Warren.*] It goes to Bathurst, does it not?

2153. *Mr. Fehon.*] Yes.

2154. *President.*] Then I want you to tell me plainly now what you think. Do you consider it safe, considering the weight of the engines themselves, and the weight of the loaded carriages that they have to draw, for them to travel over that bridge in its present condition?

2155. *Professor Warren.*] It is a 60-foot span.

2156. *Witness.*] I do not remember what the stress would come out at. Of course, anything that is under the limit of elasticity is perfectly safe, but it shortens the life of the bridge every time a heavy load goes over it.

2157. *Mr. Brown.*] As a matter of fact, these engines do go over it, don't they? Yes.

2158. What I want to know is, whether there is any danger on that account? I do not consider that there is any immediate danger.

2159. *Professor Warren.*] But you would not like to subject a bridge of that kind to 7 tons tension? No, I would take prompt measures to strengthen the bridges.

2160. I do not say that the Solitary Creek bridge is not safe, you understand? Well, the stress would not be in proportion to the live load; it would be in proportion to the 70 tons plus the dead load, in the case of the lighter engines, as against 92 tons plus the dead load in the case of the heavier engines.

2161. As a matter of fact it is 97 tons, not 92, in the case of the Consolidation engines? The dead load would be about 12 cwt. to the foot.

2162. About that? Well, that is a little over half a ton.

2163. It is all in the report of the Bridge Commission, and I am sorry that I have not got it here. We will get it, however, and then we may like your opinion as to the stability of those bridges that are built by the Construction Branch, although you were not in charge at the time. We ought to have your opinion as to whether the various bridges will carry the load brought upon them by the Baldwin Consolidation engines without being strengthened? Very well.

2164. *President.*] With regard to the platforms, you say that Mr. Whitton gave instructions, I suppose, that they should all be built to a certain gauge? Yes.

2165. Would it have been part of his duties as Engineer-in-Chief to tell his officers what distance to put the platforms apart, and whereabouts to lay the rails? Yes, these dimensions will be seen in the drawings.

2166. Which would be either prepared by him, or done by his officers under his supervision? Yes.

2167. *Professor Warren.*] The drawings will show the position of the platforms, the position of the rails, and all particulars with regard to the buildings on the platforms? Yes.

2168. *President.*] Suppose they were really not built to gauge—suppose it was found that they varied 7 or 8 inches, how could you account for that; would it be through the shifting of the rails? Well, I cannot account for it at all. I do not know that I need account for it, because I understand that the work was done by the Existing Lines Branch, and not by Mr. Whitton's officers.

2169. But, however that may be, can you account for the variations? No, I cannot; I can understand that on certain portions of the older lines the gauge may be wrong as compared with the present gauge, because I think that before the year 1878 the gauge was narrower. The platforms were placed closer to each other where there was a pair; where there was a single platform, closer to the centre of the rail. The distance used to be 4 feet 9 inches from the centre of the road. From that date, or from some date about that time, it was made 5 feet.

2170. *Professor Warren.*] That is from the centre of the rail to the edge of the platform? Yes, previous to that time all rolling stock was generally made narrower. I believe it was then altered to suit a new type of engine, but since that time, so far as I am aware, everything that has been done by the Railway Construction Branch has been carried out to that gauge—that is, 5 feet from the centre of the rails.

2171. *Mr. Hoyle.*] And was that 5-foot gauge adopted on the Illawarra line? Yes, it was.

2172. Do you say that Mr. Firth was the officer who measured the platforms when this question came up? Yes; he was in charge of the construction of the Illawarra line—up to this side of the Coal Cliff tunnel.

2173. That is the last tunnel from here? Yes, the last of the long tunnels.

2174. And who was the officer beyond that? Mr. Alexander.

2175. *President.*] I think you wanted to ask a question, Mr. Fehon.

2176. *Mr. Fehon.*] I wanted to ask Mr. Deane whether, in his opinion, an engine of the weight of the Baldwin engine or two lighter engines put together to draw the same load would be more disastrous to the permanent-way? I dare say one good steady engine strong enough to carry its load would be less on the permanent-way than two lighter engines.

2177. With regard to the bridges, we shall be prepared to give you all the information you asked for in evidence. We have had reports of all the bridges and railway structures made since the arrival of the Baldwin engines.

2178. *President.*] Very well; that seems to be a very important matter, because if these engines were unsuitable to the bridges, then it would amount to the fact that they were unsuitable to the permanent-way.

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H. Deane.
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Mr.
H. Deane.
21 April, 1892.

2179. *Mr. Fehon.*] Yes; the surface of a bridge might be considered permanent-way.
 2180. *Professor Warren.*] I think so, certainly for the purpose of this enquiry.
 2181. *Mr. Fehon.*] With regard to the proposed tests of engines, the Railway Commissioners seem to think that after the evidence we shall be able to place before you, you may consider that there is no necessity for any of these trials.
 2182. *Professor Warren.*] For any trials?
 2183. *Mr. Fehon.*] Yes, for any trials; we hope that we shall be able to give you such substantial information in regard to these engines and to the other engines—because every engine has its maximum load, and we can tell you what their performances are under these loads—that it will be unnecessary for you to make the experiments.
 2184. *President.*] Perhaps Professor Warren will hear the evidence and then decide the matter.
 2185. *Professor Warren.*] If we can get out of making the trials so much the better.

TUESDAY, 26 APRIL, 1892.

(The Commission met at 2 o'clock in the Board Room, Colonial Secretary's Office.)

Present:—

F. E. ROGERS, ESQ., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E. | ALEXANDER BROWN, ESQ., J.P.

Edwin Molloy Halligan, being sworn, saith:—

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2186. I am divisional engineer on the norther division of the railways. I have been seventeen years and three months in the railway service.
 2187. *Mr. Hoyle.*] Since you have been divisional engineer in the northern district have any alterations or additions been made to the platform at Murrurundi and Farley? Yes.
 2188. Can you tell us when these additions or alterations were made? I could not from memory tell the exact date.
 2189. Were plans issued for the work from your division? No; not from my office, but from the head office.
 2190. I presume such plans would be seen by the head engineer? Yes.
 2191. *Mr. Brown.*] Try and fix some date if you can, he may give you the year or month.
 2192. *Mr. Hoyle.*] When was it? About fourteen months ago, I should say.
 2193. Have there been any addition since that? No; I think not.
 2194. Have any additions been made to the structure or permanent-way since the Baldwin engines came here? No.
 2195. Have you made any alteration to them since the Baldwin engines came to Newcastle. We made some alterations to the buildings, but not to the platforms.
 2196. You are quite sure? Yes.
 2197. Did you accompany other officers on a trial trip of the Baldwin engines to the north? Yes; I did. I was away about four days altogether.
 2198. What was that trial for? To see if she would go over the lines and through the stations properly, and to give her a trial run was what I understood from the locomotive engineer.
 2199. Was it necessary after this trial to do anything to the platforms to permit these engines to go by with safety? No; nothing was done since.
 2200. Then you say positively that no alterations were made to the Murrurundi and Farley Platforms since the engines came here? Yes, I say so.
 2201. *Mr. Brown.*] Were any alterations made prior to the engines arriving? Yes.
 2202. How long before? They were altered six months before, and some up to date of arrival in Newcastle.
 2203. Were many of them altered? A great number of the platforms.
 2204. Nearly all of them? Yes; nearly all on the old line.
 2205. When were these alterations begun? About fourteen months ago.
 2206. January, 1891? Yes; I think that is the date about fourteen months ago.
 2207. You know the Baldwin passenger and Consolidation engine;—I presume you know their weights? Yes.
 2208. They are, I think, 92 and 97 tons respectively? Yes, I believe so; the one is 92 tons and the other somewhat heavier.
 2209. Do you think, as an engineer, that the running of these engines at a high rate of speed, (say) 20 miles an hour, would in any way injure the road? No; certainly not.
 2210. You do not think it would have an injurious effect upon the permanent-way, such as spreading or causing extra repairs, or requiring extra vigilance for watching the road? No; I am certain from my experience that it is not so.
 2211. But you have had very little experience of these engines upon that road, because, as a matter of fact they have run for a very little time upon it;—have you had any experience of engines of a similar weight? Yes; the couple engines.
 2212. The old Consolidation you mean? They did more damage to the road.
 2213. Why? I do not know; but the effect is not so great now—not so great as formerly, but what the reason is I cannot say.
 2214. *Professor Warren.*] They weigh 75 tons, I believe? Yes, I believe so.
 2215. *Mr. Hoyle.*] Did they affect the road injuriously? Yes.
 2216. But these engines are heavy, and yet you say that they had no injurious effect upon the roadway? Well, they did not give the same trouble to the men.
 2217. How long were these engines running upon the Northern line? Well, they have been running on and off.
 2218. Have you any running now—I mean the Baldwin passenger engines? Yes; I have seen them within the last fortnight myself. They have been running from Newcastle to Sydney occasionally.
 2219. *Professor Warren.*] Was it the express train. I do not know. It was the Saturday afternoon train

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2220. *Mr. Hoyle.*] Do they run regularly now? No.

2221. Well, how long were they running from Newcastle north? They have not been running from Newcastle north at all. I have not any information as to that at all. I am only giving information with regard to their running between Newcastle and Sydney.

2222. Do you consider that under the circumstances, considering that they have been running so short a time, you have had sufficient opportunity to form an opinion? Yes; I have formed my opinion as I have given it to you.

2223. Then it is your opinion that these engines have no injurious effect upon the road? No more than you would expect any ordinary engine to have. You must expect all engines to have some effect on the line.

2224. Would the running of these engines without any extra supervision would you not say put the road in state of disrepair and make it dangerous? Certainly not.

2225. *Professor Warren.*] You stated that the Consolidation engines which the Baldwin Engine Company supplied some time ago are 75 tons weight, and some of them, I understand you to say, would have a greater effect upon the road in causing spreading and in requiring repairs than the new passenger engines we are dealing with? Yes; that has been my report, sir.

2226. Do you not think that it is somewhat remarkable they are built by the same firm and have the same ratio; the only difference is that one is heavier than the other? The engines which ran the express trains prior to the Baldwin engines were coupled; we had two coupled together.

2227. Oh, then what you mean is that two engines coupled together had greater effect upon the roadway than one of the Baldwin engines? Yes.

2228. I understood at the time that you referred to one of these 75-ton engines, then what you do mean is that two of these engines coupled together produce a greater effect upon the roadway—far greater? Yes.

2229. *Mr. Hoyle.*] I understood you to mean that the old Consolidation engine, weighing about 75 tons, had a worse effect upon the permanent way than the engines now run? I meant the express train—the two engines coupled together, as to one of these engines and the Baldwin engine I could not have any means of comparison.

2230. You have had engines running express without the assistance of another engine? Yes, and some of them are running now. The English engines are running in the service now. The last engine which came here.

2231. Is it running occasional trips? Yes.

2232. *Professor Warren* (to *Mr. Hoyle*).] But you were making the comparison, as I understood it, between two engines coupled together and the Baldwin engine? Yes, that goes without saying.

2233. *Mr. Brown.*] You told us that nearly all the platforms had been altered in the north—why was that? In order to get uniformity of gauge, I understood. There was a conference of engineers in Mr. Goodchap's time—in 1888, before the line was opened to Hawkesbury. Before I took charge of the northern district the platforms were all different gauges, and he wanted uniformity in them.

2233½. When was this work absolutely commenced? About twelve months afterwards—about June.

2234. Were these platforms altered prior to the importation of the Baldwin engines? Yes.

2235. Do you know whether they were altered before you started on the trial trip of which you have spoken? Yes, I know that they were all altered.

2236. You did not see the engines touch anywhere? No.

2237. Did the cab of the engine touch any of the platforms? No, it did not touch anywhere, but it was very close at some places. It was close at Cockle Creek.

2238. Were any alterations made after this trial trip? Yes; spouting was lifted about 3 inches at East Maitland and Cockle Creek.

2239. So far as you know, did these engines give satisfaction? I do not know, sir. I could not express an opinion upon that.

2240. Could you express an opinion whether they were suitable for our permanent way? Yes, sir.

2241. You have no hesitation in giving a qualified opinion that they were suitable in every way? Yes.

2242. *Professor Warren.*] You say that certain platforms were altered upon the Newcastle and Sydney line. Well these lines have not been very long opened but the platforms were built originally in Mr. Whitton's time;—do you imply that Mr. Whitton's officers built them out of gauge? I do not imply that, but I found them slightly out of gauge. The road may have been built out of gauge, but I cannot say the reason why they were slightly out of gauge, as a matter of fact.

2243. Did you measure between the platforms? No, sir, I measured from rail to platform.

2244. Well, what was the greatest difference? I said that I measured from rail to platform, but I may add that in the case of a double line with big platforms we would measure over all.

2245. What you have said practically amounts to a charge that the Construction Branch constructed these lines out of gauge, and later on we shall have to ask some questions about that; but did you find any great difference between them? No, only in one place did we find any considerable difference. The difference might arise from pulling or setting out.

2246. Then you would not say the Construction Branch built the structures out of gauge? No, I would not say so. The difference was so trifling on the Sydney line, and the other lines are all old things, that from Newcastle from 30 to 35 years old—they were built any way, old wooden platforms. Some of these were 2 feet and 2 feet 6 inches from rail, and 3 feet to 3 feet six inches high.

2247. *Mr. Brown.*] Did you measure the Newcastle station? The Newcastle station is very shallow—being of a curve, the steps of the carriages might catch as the train came round quickly.

2248. *Professor Warren.*] What was the biggest alteration you made so far as you can remember? Taking it from the rail, I should think about 4 inches would be the greatest.

2249. *Mr. Brown.*] You remember the young fellow with you on the trial trip named Robertson? Yes, sir.

2250. Did he observe a small contact when you were passing by Maitland. He says in answer to the question, "Were you watching throughout, and are you speaking of your own knowledge when you say it did not touch any of these verandahs or platforms? I say it did not foul any of them. Did it not hit any of them? No. Did it not knock any portion away? No; not that I am aware of." Well, would that be incorrect so far as East Maitland was concerned? It would not be incorrect, sir, because I said we passed there very close—and we were going slowly; if we had passed there going fast we might have touched.

2251.

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2251. *President.*] And therefore it would be wise to take down those parts of the structure that touched or nearly touched? Yes.
2252. *Mr. Hoyle.*] Do you remember if an engine went out of Newcastle with a gauge fastened to the buffer stock? I do not remember it, but I understand that it was so.
2253. *Mr. Fehon.*] I have already objected to this question previously—the engine Mr. Hoyle is asking about is not a Baldwin engine.
2254. *Mr. Hoyle.*] What I want to point out is that this gauge was put on to show the size of the Baldwin engine cylinder so that the necessary alterations might be made before the Baldwin engines were sent out; I want to show that that was the object of having the gauge fastened to the buffer stock.
2255. *President.*] If that is so, and Mr. Hoyle wishes to show that this engine was made the same width as the Baldwin engine by putting a bar across it, in order, as he says, that these alterations might be made prior to the Baldwin engines being brought out here, would not that be evidence, Mr. Fehon?
2256. *Mr. Fehon.*] My object in making the objection was to limit the inquiry to the question of the Baldwin engines themselves.
2257. *President.*] Well, practically, are they not trying to make out that this engine was the same as the Baldwin in its effects.
2258. *Mr. Fehon.*] I do not want to object except to limit the inquiry.
2259. *Mr. Brown.*] I should have thought it would be a right thing to do to test these platforms before the arrival of the engines.
2260. *Mr. Hoyle.*] Will you tell us, then, why, having already put the platforms to gauge, why such an engine should be sent out to try the platforms and ascertain their gauge?
2261. *Witness.*] I have not any reason, the first engine I know anything of, so far as ascertaining the gauge of the line, was the Baldwin engine itself.
2262. Was there any doubt about the Baldwin engine being so wide that the cylinders would come into contact? I was satisfied that they could not.
2263. Was it to try the engines over the road as much as to test the gauge of the platforms that this trip was made? My instructions were to try the platform.
2264. Then there was a doubt on your mind? My instructions were such as I have said, and I carried them out. I put the lines back to a uniform gauge.
2265. If you had been consulted about sending this engine out with the gauge, you would not have recommended it? I did not think anything about it, and I did not know anything about it till it came back.
2266. *President.*] Would it not be a proper precaution to take to have a practical test made? Yes; it would be better, I think, sir.
2267. *Mr. Brown (placing document before witness).*] Look at these figures. Judging by those figures, how much do you think the Newcastle Station would be out of gauge? I should think $4\frac{1}{2}$ inches.
2268. What does this "cant" mean? That is to allow for the curve.
2269. These are the figures supplied by the Railway Commissioners, showing the difference between the platforms and the uniform gauge. Now, as a scientific man, how much is the Newcastle line out? These are the old measurements.
2270. Bringing it into line again—bringing this platform to gauge—you would have to make some alterations, would you not? The Commissioners, I understand, wanted to bring all the lines into uniform gauge in accordance with the Board of Trade Regulations.
2271. Now, I ask you how much would be required to bring the Newcastle line to this uniform gauge? Four and a half inches, sir, I think, to make it to the 2 feet 8 inches—that is the uniform gauge. It formerly measured 2 feet $3\frac{1}{2}$ inches. Now it would be 2 feet $8\frac{1}{2}$ inches.
2272. What was the size of the coping-stone you removed from that station? About 9 inches wide, I think, sir.
2273. I do not understand this uniform gauge, why should it be necessary to take up a coping-stone of 9 inches in width in order to add $4\frac{1}{2}$ inches to the gauge? We only moved it back, sir; we did not take it up. We put it back $4\frac{1}{2}$ inches from the edge.
2274. I see, that leaves it now $4\frac{1}{2}$ inches more than it was? Yes.
2275. *Mr. Hoyle.*] Is your gauge now from the edge of the platform to the top of the outer edge of the rail 4 feet 9 inches? No, it is 2 feet 8 inches; the whole line would be 5 feet.
2276. Do you know that the English standard gauge is 2 feet $2\frac{3}{4}$ inches?
2277. *Mr. Brown.*] Where is that measured from?
2278. *Mr. Hoyle.*] From the top of the platform to the outer edge of the rail next to the platform. In England the gauge overall is 4 feet 9 inches, but taken from the coping-stone to the outer edge of the nearest rail is 2 feet $2\frac{3}{4}$ inches.
2279. *Mr. Brown.*] Do not the Railway Commissioners measure the distance from the centre.
2280. *Mr. Hoyle.*] I suppose they do, and from the inner edge also.
2281. *Mr. Fehon.*] You might explain that prior to the Commissioners taking office you represented to the Engineer for Existing Lines that many of the platforms were out of gauge, and pointed out the desirability of bringing them into gauge.
2282. *Witness.*] Yes, I did do so.
2283. *President.*] He said, I understood, that this was done in the year 1888? Yes.
2284. *Mr. Brown.*] He was, I understand, the first to draw attention to it.
2285. *Witness.*] I wanted the whole of these alterations to be made at once, but the late Commissioner said no, that they should be done as the men were available for the purpose. It has been a stock job, and we have done it as opportunity enabled us.
2286. *President.*] You set about it in June, 1888? Yes, it was in June, 1888.
2287. *Mr. Fehon.*] The Commissioners took office in October, 1888.
2288. *Witness.*] My answer came from the late Commissioner, Mr. Goodchap.
2289. *President.*] When was it put earnestly in hand to make a regular job? I think about twelve months after that. As nearly May or June in 1889 as possible. It was then begun as regular business. We had been pottering at it up to that time.
2290. It was then you made a regular job of it in order to do the matter out of hand? Yes; and I think it was about 1891 before it was finished completely.

2291. Was it towards the end of that time that the work was hurried on? Yes, it was finished off rather quickly.

2292. Why? I do not know.

2293. *Mr. Fehon.*] I admit that the work was hurried on in anticipation of these engines coming. It was hurried on at the last in consequence of the Baldwin engines being brought out.

2294. *Mr. Brown.*] In consequence you say of these engines?

2295. *Mr. Fehon.*] It was not begun on account of them, but it was hurried on on account of them.

2296. *President.*] Do you know whether any of the Baldwin engines are running on the Northern line beyond Newcastle? Not regularly. There have been a few trips made by them on that line.

2297. Have they run as far as Wallangarra? Yes, I have taken one right through there.

2298. *Mr. Hoyle.*] With a train? No. I do not know the traffic there on that part of the line. I do not know how far they go once they leave Newcastle.

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Mr. John Love, being sworn, said :—

2299. I am an Engineer, and served my time in that calling. I have been nearly fourteen years in the Railway Service of this Colony. Thirteen years and six months, I think, is about the exact time. I was leading fitter, but now I am advanced to S. S. Inspector, Junee.

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2300. *Mr. Hoyle.*] Since you have been stationed at Junee have any of the Baldwin engines come under your notice;—have any of them run beyond Junee? Yes; between Junee and Goulburn.

2301. Since you have been there did a bogie axle break at the Junee Station? The right trailing bogie axle failed in the yard after it had left the down express.

2302. *Professor Warren.*] What speed was it going at? I do not think more than a mile an hour.

2303. I merely wish to know whether it was running fast or not at the time the axle broke? It was running, I think, at about the rate of a mile an hour.

2304. *Mr. Brown.*] Do you know the rate at which it was going before it came into the shed—the rate during the trip? I do not know.

2305. Cannot you give us some idea of what it was? It would run at the rate of over 30 miles in some places.

2306. It would be 20 or 30 miles, eh; I only want to know the average rate of speed that a train like that would run between these places? It would run from 30 to 35 miles an hour I should think.

2307. *President.*] How many days or weeks had it been running in this service? It was in the district, I think, not more than three weeks.

2308. *Mr. Hoyle.*] How long was it from the time you unhooked the engine from the train—which was an express, I understand? Yes.

2309. Was it full of passengers? I could not say.

2310. Was it full? I cannot say.

2311. How long a time elapsed between the engine leaving the express train until the axle broke? About ten minutes.

2312. Did it not break whilst it was going from the train to the sheds? I could not say. I was in bed at the time.

2313. What report reached you? I was called out of bed and was told that the engine had been derailed. I got up at once and went there, and discovered that one wheel was off—that is to say, the axle had parted.

2314. Is not there an incline coming into the Junee Station? Yes.

2315. And what speed was the train coming down that bank to the station at? Well, at about 30 miles an hour.

2316. Then you say that this wheel broke just after the engine had been taken off the main line?

2317. *President.*] He says he does not know exactly when it broke—is not that so? Yes; I could not say whether it twisted or broke, but it came off from the state of heat.

2318. *Mr. Hoyle.*] What was the consequence; was the train disabled? No; it was going on to Albury by that time.

2319. Well, I mean the engine; was it disabled when the axle broke? Yes, partly; but by a little work I was able to run it into the shed easily enough.

2320. Well, suppose the axle did break coming down the bank at 30 miles an hour, what would be the result? I cannot say. It might have been a considerable accident, but I do not think that human life would have been endangered.

2321. *Professor Warren.*] What was the position of the axle? It was the right trailing-wheel of the bogie, or truck of the engine.

2322. *Mr. Brown.*] And he says that he does not think that an engine coming down a bank at about 30 miles an hour would endanger life if its axle broke.

2323. *Professor Warren.*] That is a matter of opinion.

2324. *Mr. Brown.*] Yes; I would not have liked to have been on it at the time.

2325. *Witness.*] The brake would have stopped the train in the length of itself—the application of the air-brake would have brought the train up within a length or a length and a half of itself.

2326. *Mr. Hoyle.*] But if the engine had gone over, and carried the carriage with it, what about the brake-van? There was not much chance of that.

2327. *President.*] I think there was no need for that question, Mr. Hoyle. We have common-sense enough to see that if an engine went over a bank and drew the train with it what would happen.

2328. *Professor Warren.*] I really do not think, Mr. Hoyle, it is worth while asking questions as to what will happen.

2329. *Mr. Brown.*] The only thing is this, that if a train is going at the rate of 30 and 35 miles an hour, and can be pulled up within the distance it is said it can be without danger to any passengers, then it does not seem to matter what kind of axles these engines have.

2330. *Mr. Hoyle.*] No; they may be wooden axles for the matter of that.

2331. *Mr. Brown.*] Exactly.

- Mr. J. Love. 2332. *Mr. Hoyle* (to witness).] How did you find these engines;—in what condition were they? They were just like other engines, with little defects in their details, which required to be seen to in order to bring them into working order; but you find that in all engines.
2333. *Mr. Brown.*] You would not call a broken axle a little defect, would you? No; not at all.
2334. *Mr. Hoyle.*] How long have you been stationed at Junee? About two years, and I was at Goulburn before that, and Penrith and Bathurst before that.
2335. What experience have you had of other new engines, besides these, within the last six years in the Service? I have had the same experience as others in the same capacity.
2336. When did the last new engines come—the Scotch Yankees? I have had nothing to do with them. I had something to do with the Vulcans.
2337. Did you find with regard to them that there was as much trouble and cost in repairing as with regard to the Baldwin engines? Well, we had a lot of trouble with them, and have a lot of trouble still.
2338. How long is it since they came here, a considerable time? Yes.
2339. And you have had no experience with new engines since then? No.
2340. What was the matter with the Vulcan engines? The valve gear was defective in them.
2341. *Mr. Fehon.*] I must object again to inquiries being made about engines not concerned in this inquiry.
2342. *Mr. Brown.*] Do you not see how it arises—the witness says the repairs were not more than those required for other engines, and how can we compare these repairs unless we have some information with regard to the repairs made to other engines.
2343. *Mr. Fehon.*] We will submit the cost of repairs in any case with regard to the Baldwin engines or other. We shall give actual facts, and not mere opinions.
2344. *Professor Warren.*] I think the question is quite legitimate.
2345. *Mr. Fehon.*] The witness knows that a certain piece of mechanical work is to be done, but other people keep the cost of doing the work against the various engines, and these items of cost are gathered together, not only from Junee, but from all the running sheds on the road.
2346. *Professor Warren.*] The question in my opinion is a right one to ask, it is another matter whether the evidence may be of any importance after or not.
2347. *President.*] I think you may ask the question, Mr. Hoyle. You say, I understand that the Baldwin engines required certain repairs, and he says that all engines require some alterations in detail. I think now you have a right to ask whether he knows of other engines, and if so, what repairs they require.
2348. *Mr. Hoyle.*] What did you find in this instance were the defective parts? They were not long enough there for me to get at the bottom of all their little defects.
2349. How long were they there? About three weeks.
2350. Do you not think, looking the fact in the face, and seeing that the engines were there only for three weeks, that the repairs were excessive, I mean the repairs that had to be effected to the engines in that time? No; I do not think so.
2351. Of what engine are you speaking now? I am speaking of the passenger Baldwin engines.
2352. You do not think the repairs were excessive? No; I do not think so.
2353. Was there any bogie axle broken at Yass? I believe there was.
2354. Was this engine attached to the passenger train? I do not know.
2355. Is that in your district? No; it was in the Goulburn district. It was, I believe, a Junee engine, at least, so I heard.
2356. Was there any trouble in regard to any of the axles of the tenders? No; not the slightest.
2357. Did you examine the wheels in any of these engines? No.
2358. Did you find any apparent defects in them? Yes; I saw what appeared to be cracks, but on sounding them, they appeared to be quite right; I sounded them with a hammer.
2359. Do you know how these tires are fastened on? Yes; they are shrunk on.
2360. Now, do you consider that when that tire was turned down to its extreme point, when you came within half-an-inch of the set screw when the tire was worn down that much, that the wheel would be safe? There is no wheel safe, if it is turned down too much.
2361. Well, would not the English wheels with the tire turned down the tire in the same way be safe? They do not go down so much. I think they go about $1\frac{1}{2}$ inch in the thread.
2362. Do you think such a wheel would be perfectly safe? Yes, I do.
2363. *President.*] What do you mean by turned down? I mean turned down in the lathe.
2364. *Professor Warren.*] A smaller diameter.
2365. *Mr. Hoyle.*] Was there any order whilst these engines were running in your district that the speed should be reduced to 20 miles an hour? No.
2366. Do you know of any breakages in connection with the draw-gear whilst these engines were in your district? No, never.
2367. Did the reversing-gear give any trouble? Not the slightest.
2368. Or the brake-gear? The brake gear is good.
2369. Do you consider, as an engineer, that the brake-gear on those engines is strong enough as it is? On the passenger trains it is quite strong enough.
2370. *President.*] When the bogie axle broke did you look at it and examine it at all? Yes, I saw it.
2371. Did you seek to find out what was the cause of the accident? I could see the cause of it.
2372. What was it? Being over-heated.
2373. Did you keep the axle or did you send it on to Sydney? It was sent on to Sydney that very day.
2374. You did not experiment with it to see what sort of stuff it was made of or anything of that sort? No.
2375. *Professor Warren.*] He would not be allowed to do that.
2376. *President.*] How long have you been a fitter? I have been twenty-eight years in the trade.
2377. And you have seen many new engines? I have had a varied experience. There are always some little things to be done in a new engine, there is no such thing as a perfect engine, I have never seen one yet.
2378. You only found out its defects by practice and use? Yes.
2379. Do these Baldwin engines, so far as you can judge, show more of these defects than other engines? Well, they have more pieces about them than an English engine—in consequence they are more liable to shake to pieces, but whilst they are new I do not think they are very much trouble, not more than other engines to keep them right.

2380. Looking at this as a new engine and remembering that there are always some little defects in these engines until you get them into proper running order, can you say that there were more little defects to remedy than in others? Well, no; I cannot say so.
2381. *Mr. Brown.*] Are you satisfied with the performances of these engines? Well, they work very satisfactorily; I have ridden on them and thought that they worked very satisfactorily.
2382. Do you consider them safe and suitable for the permanent way of the Colony? Yes, at a restricted speed.
2383. Do you think you could get better engines for the work they have been doing? Yes, I think I could get better engines.
2384. Which? Some of the Scotch, I think.
2385. Do you think they would do the work just as well as these? Yes.
2386. And not better? Yes, better sometimes.
2387. *President.*] Do you believe in English engines? They are more compact.
2388. *Mr. Brown.*] You are better used to Scotch and English engines perhaps? Yes; I have had a good deal of experience of American engines here, and I have no reason to be dissatisfied with them, they do their work well, and the repairs are not excessive.
2389. *President.*] But you like the Scotch engines better than the American, eh? Well I have built some of the Scotch myself.
2390. Do you like them better than the English? Well, I cannot say I like the English better than the Scotch.
2391. *Mr. Hoyle.*] Whilst the express service was running in your district two engines were required of any description, other than the American engines, to draw them? Yes. When the American were stopped they were pulled by two engines, the trains were so heavy; I had to use two engines to do the work of one American.
2392. Why were they taken off? I cannot say.
2393. *Mr. Brown.*] They gave you every satisfaction, you say, and they were doing the work of two engines.
2394. *President.*] He said that for the work they were doing one American engine could do the work of two others,
2395. *Mr. Brown.*] I understood you to say that when they took off the American engines from the express service they had to put on two ordinary engines to do the work of one American engine, and yet you cannot say why they were taken off? I think they were stopped from running pending the examination of the axles. I cannot say all the axles, the axles of the bogie wheels at all events.
2396. These engines have been replaced in your district, have they not? No.
2397. *Mr. Hoyle.*] Have you any experience of the Scotch-Yankee engines? Yes; I have seen them work and I have ridden on them.
2398. Do you consider the Baldwin engines as better than they are? I do not say that.
2399. Do you consider that the Baldwin engine is better than the Scotch-Yankee? I cannot tell that, I have not had the experience.
2400. *Professor Warren.*] I do not think that I would ask these questions, Mr. Hoyle, they do bear upon the inquiry in a sense, but they are so remote that I do not think that any answer you get would be of any great value.
2401. *Mr. Hoyle.*] Can you tell us how many of these engines were in your charge? Nos. 453 and 456. No. 452 is the one that broke down at Junee and No. 456 failed at Yass.
2402. *Mr. Fehon.*] It might perhaps save a little time to the Commission and all of us if it were borne in mind by Mr. Hoyle that the Commission admit that the bogie axles were defective, and have had to be supplied and have been supplied at the expense of the Baldwin Engine Co. This person has been brought here several hundred miles to tell the Commission what we already admit that these bogie axles were defective.
2403. *Mr. Brown.*] But he can tell us the circumstances under which the bogie axles were broken.
2404. *Mr. Fehon.*] We admit that the bogie axles were broken.
2405. *President.*] That is admitted, I understand. The bogie axles when they came here were bad, and have since been replaced.
2406. *Mr. Hoyle.*] I wish to show not only that one broke at Junee, but also that one broke at Yass. I think it is for you to ascertain whether there was any negligence or not in not taking these axles off immediately after the breakage.
2407. *President.*] Our duty you understand is to find out whether these engines were or are defective, whether they are suitable or unsuitable to the permanent way, and whether they are doing or are not doing the work they were expected to do; and I understand you to say with regard to the latter words of the Commission that they were not doing the work they were expected to do, that you were not prepared to bring any evidence on that point.
2408. *Mr. Hoyle.*] I said that I never said that they were not doing the work that they were expected to do, nor did I ever hear anyone else say so, and I pointed out that I was in fact making certain charges and my contention was that the Commission should try the charges I had made.
2409. *President.*] There is no charge that I know of under which what we seek to show now would be evidence. We cannot go on to inquire whether the railway people have been guilty of negligence in running something that they knew to be defective. There is nothing of that kind in any of the charges. It might perhaps be a very good thing if the whole question whether the department ever showed any neglect in its administration should be gone into, but our Commission is not so worried. We have only to determine whether they are defective or not suitable or not doing the work for which they were ordered.
2410. *Mr. Brown.*] Did I not understand that you proposed to give evidence as to certain allegations against the Commissioners, which you said had been made in the Press, that you intended to call some of the reporters in connection with this business—how then can you say that you have abandoned the charges contained in the Commission. Did you not allege that the Commissioners asserted that they were going to do certain work, and that you would prove from the reporters that these reports came from the Commissioners, and that these communications had not been borne out by facts?
2411. *Mr. Hoyle.*] I take up my position from what was in the public Press, and it was alleged in the Press, through the medium of inspired paragraphs, that these engines were going to do double the work of the old ones.
2412. *Mr. Brown.*] Well, is that not included in the last part of the paragraph?

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- Mr. J. Love. 2413. *Mr. Hoyle.*] I say that, as a matter of fact, they were not intended to do double the work, and what I intend to call the reporters for is to show that they were brought here to run the express service, and that they were afterwards taken off, and also that if they have had double the work put upon them that the draw-gear would become unsafe. I say they were brought here for the express service, and were afterwards taken off that service.
2414. *Mr. Brown.*] Well, then, will you go on with the last part?
2415. *Mr. Hoyle.*] Yes, I will go on with it.
2416. *Professor Warren.*] We have put the tests aside, and we are now waiting for evidence as to what is really the power of these engines, and when we get that evidence from the Commissioners we shall decide whether these engines are doing the work they are expected to do or not.
2417. *Mr. Hoyle.*] Then I will withdraw my objections with regard to the last paragraph.
2418. *Mr. Fehon.*] As to the negligence in keeping the engines at work after these axles had broken, it might clear the way, if I stated now that three axles which were broken broke within eighteen hours of each other.
2419. *Mr. Hoyle.*] I ask why were they not immediately withdrawn from the passenger traffic.
2420. *Mr. Fehon.*] The passenger engines were immediately withdrawn, every one of the Baldwin engines was stopped from running a mixed or passenger or a mixed train from that time.
2421. *Mr. Hoyle.*] Were they stopped from running a goods train?
2422. *Mr. Fehon.*] Possibly not.
2423. *President.*] Supposing, Mr. Hoyle that you wanted to make a suggestion that these trains were run with neglect, has that anything to do with the matter we are inquiring into?
2424. *Mr. Hoyle.*] Yes; I think so.
2425. *Mr. Fehon.*] I thought it my duty to make the statement that I have.
2426. *President.*] I understand, Mr. Fehon, you wish to state the facts you have referred to on account of the Press being here, and that without your explanation an erroneous impression might be conveyed to the public.
2427. *Mr. Fehon.*] Yes.

John Fullerton, being sworn, said:—

- Mr. J. Fullerton. 2428. I am an engine-driver at Bathurst, and I have been twelve years in the Railway Service of this Colony, up to the 20th of January last; I began as an engine-cleaner, then became a fireman, then a driver. I have been driving for twelve years, come the 1st of June next; I drive from Bathurst to Penrith, and I was driving until a month ago from Sydney to Bathurst, and from Bathurst to Sydney.
2429. *Mr. Hoyle.*] Did you drive one of the Baldwin engines? Yes.
2430. Could you tell us whether you had any trouble as a driver with those engines? No, I had no trouble with the running of the Baldwin engines.
2431. Have you had any failures in any of their parts? Yes. I had one failure, the eccentric-strap broke.
2432. When was that? On Good Friday last.
2433. Did that engine break down—was she disabled? Yes, on one side.
2434. Did you drive her further? Yes; I took her to Penrith with a passenger train with another engine attached.
2435. Another engine having to be sent for? Yes. It went from Mount Victoria to Hartley Vale.
2436. Was that in the Penrith district? No; I do not think so.
2437. Do you know whether the engine came from Eskbank or not? No; it came from Mount Victoria.
2438. Where did you break down? Hartley Vale.
2439. A telegram had to be sent on for assistance? Yes; I was sending my fireman by the tricycle, and I wanted them to be ready on the arrival of the man, so as the engine would travel with all possible speed.
2440. That is the ordinary precaution of the driver to take in this case? Oh, yes; we do that to expedite the work.
2441. Have you had any failures of the draw-gear? No.
2442. Any of the reversing-gear? Yes, one. The back pin of the reversing screw.
2443. Do you mean the fulcrum pin? No, that is in the middle. It was the back pin of the reversing-screw.
2444. Did you ever receive a notice of this kind:—

Notice to Drivers.

The number of broken draw-hooks is increasing considerably notwithstanding all that has been done in the way of strengthening the draw-gear. It is feared that drivers are depending too much upon the increased strength of the draw-gear, and are becoming less careful. The application of the steam-brake is a frequent cause of broken draw-gear. This brake is only for use in emergencies and should not be depended upon for ordinary purposes. It has been decided that all cases of broken draw-gear shall be printed in the minutes of the Traffic Conference, when all particulars, including the names of the men concerned, will come under the notice of the Commissioners.

2445. *Witness.*] Yes, I remember some such notice as that, Mr. Hoyle.
2446. *Mr. Brown.*] What are you seeking this information for?
2447. *Mr. Hoyle.*] It has been alleged that the failures in the draw-gear were owing to the carelessness of the drivers in applying the brake, that is why I am getting this notice in, it were issued before the Baldwin engines were imported.
2448. *Mr. Brown.*] All right.
2449. *Mr. Hoyle.*] Do you know whether any draw-hooks or many of them have broken in connection with these engines in your district? I do not know of any.
2450. Is it a fact that when this draw-gear breaks it does so through the carelessness of the drivers by jerking their engines or putting an undue strain upon the hooks? Well, if I were to break a draw-bar I should be able to tell you, but I have not, if I had broken this draw-bar I should be able to tell you whether it was broken through want of experience on my part or not, as a matter of fact I have only broken about two draw-hooks in twelve years, so that I do not think that I can be put down as anything but a very careful driver.
2451. *Mr. Hoyle.*] I am glad to hear that, because I have understood that you people are always breaking draw-hooks.
2452. *Mr. Brown.*] Some of them are pretty good at it. *Witness.* I can only speak for myself.

2453. *Mr. Hoyle.*] Do you think there is much carelessness amongst drivers in this matter?

2454. *President.*] What does his opinion about other drivers matter? If you can get the other drivers themselves to prove that they have broken draw-gear, well and good; but his opinion is nothing on a point like that.

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2455. *Mr. Hoyle.*] Can you tell us generally whether these men are careful or not? I cannot say anything but that they are a careful class of men, because before going to driving they are examined on their merits, as to whether they understand their business or not, and also examined as to the Westing-house brake, and supplied with a pamphlet showing how they are to use them; very often firemen are promoted from the foot-plate of passenger-engines, and they have every chance of seeing how the brake works; these men before promotion are examined by the Locomotive Inspector, and as I have said, supplied with a copy of this pamphlet.

2456. You can assert positively that no brake-gear—I mean the rod attached to the brake—has been broken so far as you are concerned, by any carelessness in applying the brake? I am quite sure of that.

2457. *Mr. Fehon.*] It applies to every engine, not only to the Baldwin.

2458. *Witness.*] Of the two draw-hooks I have broken, one was about ten years ago, and the other about six years.

2459. *President.*] Did you drive a Baldwin engine? I have been driving Baldwin engines for about the past twelve years, sir.

2460. But I refer to the recently-imported Baldwin engines? Well, I have had one of the new ones from the 31st December, 1891.

2461. Up till now? Yes.

2462. Well, what do you say of them, as an engine-driver? Well, my opinion would be borne out by results of what I have done. They are good engines, capable of doing their work, capable of doing the work they have been imported to do, if not more. I have done more than I have been asked to do with them.

2463. Did you find the draw-gear defective? No; one of the strongest draw-gear of any engine in the country.

2464. Did you find anything wrong with the reversing-gear? Well, sir, one pin broke.

2465. Is that easily remedied by a larger pin being put in? Yes; I think it could be.

2466. Is it very serious? Well, it is serious, and it is not. It is a matter of delaying an engine a little while. I was only booked 4 minutes late by the guard on account of the breakage.

2467. *Mr. Brown.*] As a driver, did these engines give you any satisfaction? Oh, yes; the engine I have driven gave me every satisfaction; I have had only one warm bogie-box since I have had her; they do their work admirably.

2468. *Mr. Hoyle.*] What is the number of your engine? No. 454. I have run her up to 42 miles an hour.

2469. Have you run any of the other ones? Yes.

2470. Was it the same as the other—no failures? It was No. 448; that was the one I had a failure with; it was not my own engine.

2471. Did you find that they took greater loads than the ordinary engines? Oh, yes.

2472. When you were going down a bank with these engines did you find any rolling with them? There were one or two of them I have to do with which were just as steady as any of the Yankees, but the one I had myself rolled a little; I would always steady an engine if it commenced to roll; I would do so if only for the sake of economy. I have had other engines roll just as badly as these.

2473. *President.*] What do you mean by "the sake of economy?" Well, if I were careless and allowed the engine to roll, I would increase the friction of the boxes, and cause them to run hot, and that would mean more oil for lubrication. I always think it right to economise by going slowly round curves, besides having regard to the safety of the passengers and rolling stock. The engine I have rolls a little more than others, perhaps, but the two others I have run do not roll any more than others.

2474. What is that caused by? It might be mere elasticity in the springs that might cause them to roll a little more than the other ones might do.

2475. *Mr. Brown.*] You are satisfied those are the engines you have been on? Oh, yes.

2476. *Professor Warren.*] Do you know the loads you have had behind you? Yes, quite well.

2477. What is the biggest load you have taken up the 1 in 30, on the Penrith grade? Sixteen and a half carriages.

2478. What does that mean in weight? Multiply the carriages by 8 tons, that is the standard weight of each carriage.

2479. *Mr. Brown.*] That would be 132 tons? Yes.

2480. That is from Penrith, unassisted? Yes.

2481. *Professor Warren.*] When you started with your engine, did you take a run at the grade? Nothing more than with any other engine.

2482. When you settled down, at what rate of speed did you go? My running time to Katoomba, taking my stops out—is that what you want?

2483. I do not want it from Katoomba exactly, but as nearly as you can? About 18 miles an hour.

2484. That is to say, you went down a grade of 1 in 30, with a load of 132 tons, at a rate of 18 miles an hour? Yes; that is, taking all the stops out.

2485. *Mr. Fehon.*] With regard to the breaking of the eccentric-strap, that is only one of such breakages that would probably occur to any engine? Oh, yes; I have seen reversing-screws broken before—there is nothing unusual in that. There is nothing that might not happen to any engine.

2486. On your return journey—you have spoken of your trip to Penrith and Katoomba—what load would you bring on a return trip? Well, I have brought twenty-one trucks, and twenty on another occasion, from Wallerawang.

2487. And you were able to mount the grade unassisted? Yes, without any assistance.

2488. *President.*] Coming up the Lithgow grade? Yes.

2489. Was the train full of passengers? Yes; some were standing in the compartments. It was the heaviest-loaded train I have ever seen. On the day I had the Governor I had twenty-one carriages, and that was just as heavy.

2490. *Mr. Fehon.*] Do you remember the 14th of April, you were driver of the second division of passenger train above 31? Yes.

2491. The first division went away with another class of engine, an ordinary express engine, and she had how many carriages on? I suppose about nine, or nine and a half, but under ten, I know.

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2492. Did she get stuck? Yes, to Lawson she lost about fifty minutes, and then I relieved her. I suggested to the guard that he should go forward to the station-master, and he should take two of them off; they made about eighteen and a half carriages, and that left him one carriage and the brake-van. With this additional load I made up five minutes of the lost time. He had been running in front of me, and then as I have said I caught him up at Lawson, and took his two front carriages and attached them to my own carriages, thus making my own train eighteen and a half carriages all told, and I then took them up to Katoomba. The engine attached to the first division had not been able to get on with nine and a-half carriages, so, instead of allowing him to block me by delaying in front, I considered it my duty to the Department and as man to man to take the two and attach them to my own carriages.

2493. What class was that? It was No. 273 that got stuck, and it belonged to the express class, the four-wheel couple generally known as the express class of engine, although as far as that is concerned my own engine is express because I ran it at 42 miles an hour.

2494. *Professor Warren.*] But you are not allowed to run at that rate now? Oh, that was before the order, so I considered myself justified in doing it.

2495. *Mr. Hoyle.*] You say that this train left here and started for the Mountains with nine and a half carriages, and that she was in the first division and you had to run behind, and that she delayed you. you then got to some station and decided to take two carriages from her, and that left her one carriage and a brake-van, what became of the other carriages? When I was speaking of carriages I meant in the sense of vehicles, they equalise the vehicles, so many vehicles are equal to so many carriages.

2496. Was this train only equal to nine or nine and a half? Yes; I know it was under ten.

2497. Then that would be four vehicles, could she not haul that load? No, it seems not.

2498. Well, if she could not she ought to have been thrown on the scrap heap.

2499. *Professor Warren.*] You speak of the carriage being 8 tons, must you not add to that the weight of the passengers in order to get the total load, are the passengers included in the 8 tons?

2500. *Mr. Fehon.*] Yes, the 8 tons cover everything.

2501. *Mr. Hoyle.*] Was it not stated to be 10 tons the other day?

2502. *Mr. Fehon.*] Yes.

2503. *President.*] I suppose the other engine would have got the carriages to their destination right enough only you wanted to hurry them up? Yes; but it was blocking me, and I considered it my duty departmentally, and as one man to another to take these two carriages; I took the carriages and made up five minutes of the time to Katoomba.

Charles Hursthouse Stanger, being sworn, said:—

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2504. I am at present employed by the Railway Commissioners of New South Wales as out-door Locomotive Superintendent in charge of the Northern and Western Divisions of the Railway system. I began to serve my apprenticeship in 1869, on the Great Northern Railway Company in England. I have been just 10 years in the service of this Colony, I commenced as a fitter at Bathurst.

2505. *Mr. Hoyle.*] I understand you, Mr. Stanger, among others recommended these engines? Yes.

2506. Did you not before you recommended them know that an order had been sent to England for engines, and do you know how many engines were ordered? I knew there were a considerable number ordered, I knew it was over 50 anyway.

2507. Did you know when you consulted with others that it was the custom to draw special attention to, and to specify for, all the materials to be put in the engine? I know that when a locomotive superintendent of a railway is ordering his own engines he makes specifications, but under the circumstances in which we were asked to suggest engines there was not an opportunity of doing that—there was not time.

2508. Why was there this hurry? I am not one of the parties who had anything to do with it, but I know there was a syndicate in England who were going to build these engines for us within a certain time, and there was some hitch and we found that we were not likely to get them at all, and we did not know how we were going to get through the wool season.

2509. Had you anything to do with the specifications of these engines? Yes.

2510. When these engines were delivered in the Colony did you see whether this specification had been carried out or not? No, I did not.

2511. Did you make any minute examination or inspection of the engines? No, not before they commenced running.

2512. Was the first intimation you got of the defects derived from the break-down? No, the drivers were reporting them hot, and we could see that there was something wrong, there seemed to be some difficulty in getting them to run cool.

2513. Did you make any minute inspection into the matter? Yes, we consulted with our drivers and improved the lubrication, and gave the engines every chance.

2513½. Well, what was your opinion, as an engineer, as to what was making these engines run hot? I think the very rough and unsuitable stuff the axles were composed of.

2514. *President.*] You are now talking of the bogie axles? Yes.

2515. *Mr. Hoyle.*] You say it was rough, unsuitable stuff; when the engine was elevated to see what was the matter with it did you make a minute examination of the journals? I do not know that I myself saw any of these journals lifted after they had been running hot, but even if I had, I could not have told that. Even now I do not know that I am right as to what was the actual cause. I am only surmising it.

2516. Then why did you say it was the rough material? Because I have seen a piece of the iron tested, and I have seen the material of which it was made.

2517. But that would not necessarily make the axle run hot? My opinion is that the material of the axle had everything to do with its running hot, and that it would not be possible for these axles to run cool at high rate of speed.

2518. Notwithstanding the lubrication? Notwithstanding the lubrication.

2519. *Professor Warren.*] You mean that the dirt inside the axle—in the material of which it was made—worked out, and that is the reason why it worked hot? Yes; that was the cause. I know that the stuff may ooze out and destroy the effect of the lubrication.

2520. *President.*] And cut into the axle? Yes.

2521. *Mr. Hoyle.*] I see by the correspondence that you cabled to America to the Company to make these engines lighter than the original Baltimore and Ohio? Yes; I know that that was done.
2522. Well, if you wanted a lighter engine, why did you specify copper fire-boxes, which would actually make the engines heavier than the original boxes would? Well, we locomotive people of English bringing up, have not very much faith in steel fire-boxes. We know the copper fire-boxes, and we can trust them, and preferred getting them, and we used our endeavours with the Commissioners to get them to pay the extra price that these boxes would entail.
2523. Did you know that you were making the fire-boxes heavier by putting in copper instead of steel? Yes.
2524. Was that order sent—that cablegram? Yes. For my own part I would gladly sacrifice the weight to get the copper boxes.
2525. You must have had some reason for reducing the weight on the driving-wheel? Yes. All locomotive engineers are anxious to keep down the weight on the driving-wheel on account of the permanent way, the greater weight meaning greater wear and tear. We did not sacrifice the utility of the engine by the loss of adhesion, but took care to see that it was maintained.
2526. Will you say that the real reason of the axles running hot was not because there was too much weight on the bogie? To the best of my belief, the cause of the bogies running hot was the material composing the iron of which the axles were made.
2527. Now, I would ask you whether, with the surface you have, and the axle the size it is, and the weight on the bogie, would not that cause it to run hot, taking your Journal surfaces into consideration, do you not think that it was the extra weight on the bogie that caused the axles to run hot? No; I do not.
2528. Does it come within your duty to know what happened to these engines outside your district? Yes, that is a chief part of my duty.
2529. Now when you had run these engines for a time, did you think that the wheel-base of the engine had anything to do with the axle and the boxes running hot? No, I did not. The wheel-base of the passenger engine is, I think, 12 feet 6 inches. I have not the drawings before me, but I think that is so.
2530. *Mr. Hoyle.*] I would like to be furnished with the drawings and the weights.
2531. Do you remember what brackets were broken in connection with the reversing-gear? No; I am not aware of anything that I would call a bracket.
2532. Were not the engines previous to the alterations to the fulcrum-pins fitted with a new brass bracket fixed on the boiler to carry the catch on the screw? I think they have all been fitted with a catch.
2533. The whole of them? Yes.
2534. At what cost? It hardly comes within my province to say what the cost would be, but I could give a guess.
2535. Then what do you think would be about the cost of each? I think these catches were brass, and would cost about 8s. or 10s. each.
2536. Would they cost £1 each? I say, I think they would cost about 8s. or 10s. each.
2537. *Professor Warren.*] Mr. Thow will supply all that information.
2538. *Mr. Hoyle.*] Is it a fact that you have fitted these engines with new brass-boxes? Yes.
2539. Does the Baldwin Company pay for them? I think they do.
2540. Does the correspondence show that they have been deducted?
2541. *Mr. Brown.*] They have made reductions about £1,200 in all in the Baldwin Company.
2542. *Mr. Hoyle.*] At Penrith an engine broke down with a loose coupled wheel. Is it a fact that you put a completely new set of wheels on that engine? I am not quite sure about it breaking down, but as a matter of fact a loose wheel was discovered and the engine was sent to Sydney, and we took the quickest way of putting her into service again, and we considered the quickest way to be putting a new set of wheels under her, so that we could repair the broken one at our leisure, it is necessary to do this if we want to get an engine back to work at once.
2543. Could you not have taken out the right and left trailing-wheels and put in other trailing-wheels in their stead? Yes, I could do that.
2544. Would it not be quicker? Yes; it would be much quicker.
2545. Then, why did you not do it? I would be very sorry to do it; it is necessary that the wheels should be all of the same diameter, and we could not take out one pair and put in a new pair without having different diameters in our set of wheels, one pair being new and the others worn even if the same size when new.
2546. Well, the result has been anyhow, that you have had to put in a completely new set of wheels? If you mean by that, that one wheel breaking has caused the loss of six wheels, it is not true. We have these six wheels on hand and can use them, and we did what I have said in order to save time.
2547. *President.*] And you will utilise the others? Yes. By putting them in another engine.
2548. *Mr. Brown.*] That is not an unusual thing to do? It is the proper thing to do, sir.
2549. *Mr. Hoyle.*] What about the other wheels;—you have the drivers and the leading-wheels left? And we have trailers also.
2550. But you will have to fix a new axle to them? Yes.
2551. What will be the result;—can you bush the wheel, or ought a new axle to be made? I think we should have to put a new axle in the wheels.
2552. And that expense would be borne by the Baldwin Company? Yes; it ought to be, certainly; but it is beyond my knowledge to state definitely whether it will be.
2553. *Mr. Fehon.*] We have £1,000 still in hand of the Baldwin Company's, and that will meet any little contingencies that may arise.
2554. Did you find any of the Baldwin Company's valve-brackets break? I do not know of any part that we generally know by that name.
2555. The rod that works the valve [*pointing out the part indicated on a photograph*]? I have not known any of the rods you have pointed out to break. The valve-buckle, that goes inside the steam-chest, has broken; we have had several breakages with them.
2556. Is that the usual thing in new engines? No; but it is a common thing among American engines.
2557. Have you mounted them with stronger buckles? Yes. In this case it seemed wise to strengthen them.
2558. The former ones, then, seemed too slight? I am not prepared to say that; this was a class of buckle that I believe does good service in America.

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2559. But not with the same grades as we have here? It is not a question of grade.
2560. *Professor Warren.*] There are some grades in America worse than those we have here, but not on the Baltimore and Ohio line.
2561. *Mr. Hoyle.*] What caused the axle-boxes to wear into the bosses of the wheel;—can you account for that? I think the material of which the boxes were made had something to do with it; a wrought-iron boss against a cast-iron box has not much chance. I think our road has something to do with it. In at least two classes of our English engine we have had similar trouble.
2562. Wearing as much in the same time? I cannot say about time, but they wore very deeply.
2563. Have you seen the wheel wearing into any of the feed-cocks in the Consolidation engines? Yes; I have seen the leading wheel of the tenders, where it has been on the curve, cutting into the brass elbow of the feed-cock.
2564. Would not that necessitate the renewal of the feed-cock? I think we have dealt with this by putting in a piece which slews the cock out of the way.
2565. Have there been any of these engines here, either passenger or Consolidation, with unsound frames;—have you seen any with unsound frames? Yes; on one of them, a passenger engine. We took it to be unsound; we took it to be a bad weld.
2566. Would that be serious? Well, we would have to stop the engine, and would have to go to some expense; but it would not cost very much. I think we could adopt a cheap method with it, otherwise it might be expensive.
2567. I think you furnished five detail drawings to the Baldwin Company according to the correspondence;—was one of these drawings for the draw-hooks? I believe a drawing was supplied for the draw-hooks; but I had not anything personally to do with that.
2568. *Mr. Brown.*] The Baldwin Engine Company admit that they made a mistake with regard to the draw-hooks, and they were ready to bear the cost of replacing them.
2569. *Mr. Hoyle.*] It has already been stated that some of the wheels of the tender axles have been loose;—has that been the case in many of them? Yes; there have been a great number of them.
2570. What has been done in that case? They have been taken out, and better and larger axles put in.
2571. Did you send to Victoria for any axles? Not that I am aware of.
2572. Did you use any of your truck axles for the purpose? I really do not know. When we got a tender with a loose wheel up the country we sent it to Sydney, and the works people dealt with it.
2573. *Professor Warren.*] You, in conjunction with Mr. Neale and others, advised the Railway Commissioners with regard to the purchase of these engines? Yes.
2574. I take it that you fix the weights to be hauled, and the speeds to be run on the various inclines, as specified in a letter of the Secretary of the Railway Commissioners? Yes.
2575. Will the engines do that work? I think they are doing more than that. Of course I must guard against being misunderstood as to what the work for which they were intended was. What I took it to mean was that it was wished that what was then the customary load on the southern express, should be taken by one engine with assistance from Picton to Hilltop. I think that the weight of that train was 144 tons, and that, I think, led to its being inserted in a letter to the Baldwin Company, that the engines were to be capable of taking 144 tons over a grade of 1 in 40 at an average speed of 30 miles an hour for the whole journey.
2576. Well, I just wanted your opinion as an engineer. I wanted to know that you are satisfied that the engines have done the work required of them according to the specification. And I suppose that we shall be supplied with returns to show that they have actually done that work? Yes.
2577. *President.*] Here is a letter from the Secretary to the Railway Commissioners, dated 22nd September, 1890:—"Government Railways of New South Wales, Secretary's Office, Sydney, 22nd September, 1890. Gentlemen,—I am directed by the Railway Commissioners to inform you that they accept the offer of the Baldwin Locomotive Works to supply twelve 10-wheeled express engines and tenders similar to those recently supplied to the Baltimore and Ohio Railway, under a guarantee to haul a passenger train of seven cars up a grade of 116 feet per mile, and 17 miles long, at a speed of 25 miles per hour." That has not been modified in any way, has it? Not that I am aware of. The engines are doing equal to that, and more than that.
2578. That is all that I wanted to know. Are the engines doing that? Yes. When I answered Professor Warren's question just now I spoke of a grade of 1 in 40. I remember that they were wanted to do a grade of 1 in 45, but that, as a matter of fact, they are really doing a grade of 1 in 40.
2579. At all events, they are fulfilling what was required of them in this letter? Yes; and a good deal more.
2580. *Professor Warren.*] Of course I take it that we shall have that proved?
2581. *Mr. Fehon.*] Yes.
2582. *Professor Warren.*] It is a very important matter.
2583. *President.*] The letter from which I have quoted also says:—"It is proposed to haul with these engines trains weighing 152 gross tons (340,500 lb.) up long grades of 130 feet per mile. This would be the usual train, and we expect it to be hauled up this grade at about 22 miles per hour. Occasionally the train would have an additional car, making the load without engine and tender, 178 tons or 394,240 lb. These loads include a full complement of passengers, mail, and baggage. The cars are all on trucks or bogies. The regular load up the 176-foot grades would be 120 gross tons (269,000 lb.) without engine or tender. These grades are free from very sharp curves, and therefore in practice a greater proportionate load can be hauled than on the 130-foot grades. It is, therefore, expected that occasionally an extra car could be hauled, making the total weight of the train 144 gross tons (322,500 lb.) without engine or tender." What engine does that refer to? The ten-wheeled passenger engine.
2584. And it will do that? Yes.
2585. *Professor Warren.*] This letter gives the sharpest curves you have and the engines are supposed to do it without reference to curves or resistance. They can do the sharpest curves on our lines, because the letter describes our lines? Yes.
2586. Will they do more than that? It is expected of them that they will do that as an ordinary thing?
2587. In the letter it says that the load must be 178 tons, but I take it that that has only reference to test performances, and that 144 tons represents the usual loads that the engines will have to carry, as a matter of fact, will they carry 178 tons?

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2588. *Mr. Fehon.*] Yes; we will produce the running sheets to prove it.

2589. These things have been called into question a great deal. Have you made any test as to what the engines will do with the loads on the 1 in 30 or 1 in 40, I do not care which you give me? Might I refer to the test?

2590. *President.*] Yes, certainly.

2591. *Professor Warren.*] You might hand in a copy, and I will consider it and ask questions upon it later on.

2592. *Mr. Fehon.*] The Commissioners are already pledged to do that.

2593. *Professor Warren.*] Yes, I know they are; and I wish I had the returns by me now.

2594. *Witness.*] This is a copy of mine. There is a copy with the report of the officers who made the test. This is not the one that the Commissioners intend to hand in.

2595. *The Secretary to the Railway Commissioners.*] We may put Mr. Stauger in the box again after a while?

2596. *Professor Warren.*] Well then, I will not press him now with regard to the returns.

2597. *Mr. Brown* (to witness).] You say you had no specifications before you at the time the engines were ordered—nothing to guide you but a copy of the *Railroad Gazette*? That is all.

2598. And I suppose that you are aware that the manufacturers said that they could not guarantee the speed of the engines after the alterations suggested by yourselves? I was not aware of that, but I was quite satisfied with what the engines did.

2599. *Mr. Brown* (to Mr. Fehon).] There is a stipulation to the effect that these engines are to run 1,000 miles before the money is handed over to the Baldwin Company. Where did that stipulation emanate from, and how did it originate?

2600. *Mr. Fehon.*] It was our proposal, but it was not adopted by the Company.

2601. *Mr. Brown.*] But here is the letter from the Company in which it is said "We have the honor to enclose invoice of the 10 per cent. due on the twelve locomotives."

2602. *The Secretary to the Railway Commissioners.*] We hold 10 per cent. retention money, and that we keep until the engines have run 1,000 miles.

2603. *Mr. Brown.*] Exactly, I wanted to know where that came from?

2604. *The Secretary to the Railway Commissioners.*] It is a usual arrangement, and in this instance we made it with the agent of the Baldwin Company here.

2605. *Mr. Brown.*] I see there is nothing in the correspondence to show just where the arrangement emanated from, and I thought that it might lead up to some question in regard to the first specification?

2606. *The Secretary to the Railway Commissioners.*] No; it is a customary arrangement.

2607. *Mr. Brown.*] And you do not pay for the engines until they have run 1,000 miles?

2608. *The Secretary to the Railway Commissioners.*] We do not pay the retention money till then.

2609. *Professor Warren.*] I suppose you have no more returns like those just referred to by Mr. Stanger?

2610. *The Secretary to the Railway Commissioners.*] The Chief Commissioner for Railways has a good deal of information that he is about to hand in.

2611. *Professor Warren.*] Well, if these returns do not represent the case it is no use going into them, I have worked out what the engines ought to do, and I can see that at least two or three are not doing it. They might all be doing less than they ought to be doing. What I want is for you to see that this is a very important matter, and that we shall have to decide with regard to the question, as to what the engines ought to do upon these returns.

2612. *Witness.*] You must remember that the reference in the returns from which I have been quoting is to coal waggons.

2613. *The Secretary to the Railway Commissioners.*] Yes, full particulars will be submitted to you.

2614. *Professor Warren.*] What is the power necessary to haul ordinary coal waggons as compared to carriages? I am not in a position to answer that question, but I think the 4-wheeled coal waggon stock must be more heavy to pull than bogie passenger stock.

2615. Do you not think that a carriage run at 22 miles an hour would offer much more resistance per unit of weight than a coal waggon? Of course it offers a great deal more resistance to the air, but I do not think that there would be so much friction.

2616. But air resistance is a very important matter? Yes; but in going up these gradients we travel very slowly.

2617. I suppose you know all about the experiments of D. K. Clarke, Searle, and Wellington? I know that the train resistance is gone into very thoroughly by Mr. Clarke and others.

2618. You do not know Wellington's work with regard to train resistance? I have just looked through it, but I do not know it in the sense you mean.

2619. *Mr. Fehon.*] I would like Mr. Stanger whilst he is giving his evidence to give the Commission some idea as to the difficulties we had before these engines arrived in carrying wool and stock on the western road, over which he is the locomotive superintendent? Well, we were working under great difficulties, indeed, we had to keep the engines so constantly running that we could not do the necessary repairs, and as a consequence we had a great number of failures on the road. That blocked the traffic and made the difficulties even greater than they would otherwise have been. We were not able to wash out the engines, and instead of keeping, as we should have liked to have kept, one driver to each engine, men would come on duty and have to wait for an engine to come in before they could go out. On one occasion, and I think this was last year, men were waiting in the shed at Bathurst for the mail to arrive from Sydney, in order that they might take the engine to work a pick-up goods train from Bathurst to Orange. The mail driver reported to his foreman that the engine's boiler was so dirty that she could not go out again with the mail-train, but notwithstanding that they were obliged to run her first of all with the pick-up goods train and then with the mail train on the following day. Engine-men working on mail trains always consider themselves very hardly dealt with if their engine is taken from them at all; but when it had to be done with the engine, in such a bad state as this engine was, it shows the great difficulty we had in working the traffic and the necessity for new engines.

2620. You mean that previously your engine-power was short? Roughly speaking, the year before last we had barely half the engines we ought to have had, and the expenses in all directions were heaped up in consequence. In order to get the work done we had to keep men working overtime, and it was in consequence of that that the expenditure was so great. I remember one engine that had been standing in the shops for several weeks—I think the intention was to break it up—but our necessities were so great that in

- Mr. C. H. Stanger. in or about October of 1890 that engine and two or three others were brought out and put into working the traffic—the less important traffic, of course—ballast and so on; but by doing that work they released other engines for the goods traffic.
- 26 April, 1892. 2621. And at the time you ordered the Baldwin engines you had been disappointed in getting some English engines, I believe? Yes.
2622. Mr. Hoyle.] Is it not a fact that you have now more engines than you know what to do with? No we have not.
2623. President.] Have you now more engines than you have use for? Well, we are now in the very slackest season.
2624. Yes, but I do not mean at this moment. Have you got more engines in the Service than there is need for? No; I do not think that when all our engines are doing work we should have more than we desire.
2625. Mr. Hoyle.] What induced you to order two Compound engines for experimental purposes when you were so hard pushed that you did not know what to do for engines to work the ordinary traffic? Well, I do not see that because they were experimental engines we therefore lost the use of them. Although we did not understand these engines, and have not learned all about them, yet they are doing the same work as any other engines did before the Baldwin engines came out. They are doing as much work as our old Consolidation engines.
2626. Professor Warren.] The question is how much they cost? Well, the Commissioners wanted to see whether it would not be more economical to use them, and I think that if I were owning the railway I should feel myself justified in spending a few hundred pounds on a similar experiment.
2627. Mr. Echon.] Mr. Stanger could tell you, as a locomotive superintendent, of the great delay in the carriage of live stock and wool that occurred in the western district before the advent of the Baldwin engine.
2628. President.] Well, I think he has already told us a good deal in that regard. You say that there were great delays, Mr. Stanger, before the arrival of the Baldwin engines? Oh, it was a matter of daily complaint from the traffic branch that they could not get engines to work their traffic. Shortly after we put the Consolidation engines on the line, indeed, before we were quite satisfied to load them up to their full power there was a great block of wool at Dubbo—at one time as many as 300 trucks loaded with wool standing at Dubbo, simply waiting for engine-power to bring them on. One Saturday night I arrived at Dubbo and found 150 trucks waiting there. In order to get them away we used three or four of these large Consolidation engines, loading them on that occasion up to their full power, that is to say, with twenty-six wagons and brake-vans. They moved as much wool as seven of the small engines would have taken, and it was from that date that we felt the great assistance that these large engines could be made to give in working the wool traffic of last year.
2629. Now about these repairs to the engines I am not talking about repairs to the bogie axles, I am not talking about the repairs to the draw-gear and reversing-gear—the draw-gear I believe was too light when the engines arrived—but leaving out of consideration the draw-gear and the bogie axles and taking account of the other parts that required repairing, have there been more defects in them than you would expect to find in new engines before they got thoroughly into their work? Not more than has been my experience with regard to other American engines. I am rather dubious about comparing them with English engines because we have found that there is not so much trouble with engines of English manufacture.
2630. But you have had American engines to deal with before coming in contact with the new Baldwin engine? Yes.
2631. Have you had as much trouble with them? Not if we are to set the bogie wheels aside.
2632. Mr. Hoyle.] Have you had as much trouble with the reversing-gear of the other American engines? No; I think not, though we had some trouble with the last lot.
2633. Had you more trouble with the last lot? No.
2634. Have you had the same trouble with the brake-gear of the other American engines? I think so. I think that the brake-gear of the first lot had to be remodelled entirely after we received them from the makers.
2635. Had you to make stronger valve buckles? I do not know that we had to make stronger valve buckles, but we had a great deal of trouble with the valves, and we had to substitute spiral springs for the springs supplied with the valves.
2636. Have you ever heard that they have cancelled trains at Penrith so that an extremely heavy load might be given to the Baldwin engines to take up the mountains? I have not heard that in the sense in which I think you mean to put it. Of course, I know that the traffic people like to reduce the number of trains where it is possible. They prefer to run one heavy train drawn by a Baldwin engine to running two light ones drawn by other engines.
2637. That is to say that goods were detained at Penrith in order to wait until a big load had been made up? I think not. I think it is the other way about—that loads have been taken from Penrith earlier than would otherwise have been the case, simply because the Baldwin engines were capable of taking them.
2638. But have not trains been delayed at Penrith in order that big loads might be given to the Baldwin engines? I do not know that they have, that is purely a traffic matter.
2639. Some trouble has been caused by the Compound engines. You say that they could only haul the load that the original Consolidation engine could haul? That is as far as we have got with them yet.
2640. How old are the original Consolidation engines? I do not know, they were here when I came, I think they came in 1879 or 1880.
2641. Well, having drawn this comparison between the Compound engines and the old Consolidation engines I should like to ask you whether you think that the Compound engines when they are twelve years old will be hauling the loads that the original Consolidation engines are hauling now? I am satisfied that they will be hauling 50 per cent. more.
2642. Mr. Brown.] Is that not merely a question of new tubes and cylinders? Not new tubes, but I think we have new cylinders for them.
2643. Professor Warren.] Is it your opinion that the Baldwin passenger engines will cost more to keep in repair than an ordinary English engine would cost? My experience is that American engines do cost more for repairs than English engines.
2644. And up to the present you think that the repairs to these particular engines, barring the axles have not been excessive? No, not particularly. I think they will compare favourably with other engines of the same type.

2645. But not with English engines? No.

2646. They are more costly to keep in repair than the English engines? Yes.

2647. *President.*] I suppose as a matter of fact that the English engines are better finished? Yes, that is it. I fancy that the American people consider that it is cheaper in the long run to build less expensive engines, and then when they are used up to throw them away.

2648. *Professor Warren.*] From this return you conclude that the engines are doing the work that was expected of them? Yes.

2649. How do you arrive at that. I have just gone through three or four sets of your figures and I may tell you that I do not think they are doing the work that is expected of them. I may say that I know they are not if these returns are correct. I have not spent many minutes over them, but you say you have made a certain test, and upon that test you have drawn a conclusion. What I want to know is by what method you have arrived at that conclusion? We have arrived at the loads by weighing the waggons filled with coal and we took the speed by the stop watch between the quarter-mile posts.

2650. You could not do better than that, but having done that how is it that you arrive at the conclusion that the engines are drawing 144 tons up 1 in 30 at a speed of 22 miles an hour? I do not know that that was ever expected of them.

2651. *Professor Warren.*] That is what was specified in the letter of the Secretary to the Railway Commissioners;—"It is proposed to haul with this engine trains weighing 152 gross tons (340,500 lb.) up long grades of 130 feet per mile. This would be the usual train, and we expect it to be hauled up this grade at about 22 miles per hour. Occasionally the train would have an additional car, making the load without engine and tender 178 tons or about 394,240 lb. These loads include a full complement of passengers, mail, and baggage. The cars are all on trucks or bogies. The regular load up the 176-foot grades would be 120 gross tons (269,000 lb.) without engine or tender. These grades are free from very sharp curves, and, therefore, in practice a greater proportionate load can be hauled than on the 130-foot grades. It is therefore expected that occasionally an extra car could be hauled, making the total weight of the train 144 gross tons (322,500 lb.) without engine or tender." Upon that I shall base my decision as to whether they are doing or are not doing the work expected of them. I will ask Mr. Stanger whether he has gone into this question and whether these tests show that the engines are doing their work which it was intended they would have to do when this letter was written?

2652. *Mr. Brown.*] But you must remember that at that time they asked the company to give them a guarantee that the engines would do certain work, and that the company refused to give them that guarantee, and that after that refusal the Railway Commissioners decided to take the engines.

2653. *Professor Warren.*] I do not think that that affects the question. The letter from which I have quoted clearly shows what the engines were required to perform.

2654. *Secretary to the Railway Commissioners.*] We ordered a certain class of engine to do a certain work.

2655. *Professor Warren.*] Exactly, and Mr. Stanger says that it will do the work, and indeed that it has been shown to do more than the work, and these returns are placed before me to prove that, and it is very unfortunate if they prove the contrary.

2656. *Mr. Stanger.*] I think it only fair that I should be allowed to state that I did not hand in these returns as a piece of evidence, I was only refreshing my memory with them, and handed them to Professor Warren because I concluded that he wished to see them. It should be remembered that these engines are not always wanted to pull trains of 144 tons up the Picton bank with a gradient of 1 in 30.

2657. *Mr. Brown.*] The Baldwin Company offered you an engine which they were prepared to guarantee, but you asked them for something else, and when they sent the engines to you, whilst they declined to guarantee them they said they would probably do more than what you asked them to guarantee them to do.

2658. *Professor Warren.*] The Baldwin Company say that these engines will haul a certain load, but they will not guarantee the speed. Supposing one engine hauls 200 tons at the rate of 5 miles an hour, and another engine hauls 200 tons at the rate of 10 miles an hour, it does double as much work as the other one.

2659. *Mr. Fehon.*] That point will be cleared up when we call our evidence.

2660. *Secretary to the Railway Commissioners.*] We have not commenced our case yet. These are all Mr. Hoyle's witnesses.

2661. *Professor Warren.*] I take it that Mr. Stanger says just what he knows in either case, whether he is speaking for the Commissioners or for Mr. Hoyle.

2662. *Mr. Fehon.*] We shall have to call him again, and will, in the meantime, obtain the necessary returns, and lay them before the Commission.

2663. *President.*] It does not matter by whom a witness is called, especially such a witness as Mr. Stanger. It does not matter whether he is called by the Railway Commissioners or not. The only circumstances under which it could matter would be in a Court where the question of the right to cross-examine, or something of that kind might crop up. Mr. Stanger will speak the truth whoever he is called by.

2664. *Mr. Hoyle.*] This is an order issued by the Chief Mechanical Engineer for the guidance of drivers and firemen. It says "Drivers and firemen who work the new Baldwin engines of both kinds are hereby instructed that on no account must they allow the level of water to get below half a gauge-glass on the levels, or when ascending grades, particularly on grades of 1 in 40 and 1 in 30—indeed on these engines they should have more than half a gauge-glass of water—and when descending grades of any kind they must take care that the water shall always be seen in the gauge-glass. Recent failures of the Consolidation boilers are attributed to shortness of water?" We have had several cases of leaking tubes.

2665. But is that caused by the gauge-glass not being in the proper place? I have not made the necessary measurements. All I can say is that since the order was issued we have had no trouble.

2666. Then under the circumstances of a driver not attending to his gauge-glass trouble did arise, and it was necessary to issue this order to drivers on that point? As these engines were new to the men, and larger than anything they had handled before, it was thought necessary to issue these instructions in order to warn them to keep up the necessary amount of water. I do not think there is anything excessive in the quantity specified.

2667. But you see the latter part of the order states that failures of the Consolidation boiler had occurred, and that they were attributable to shortness of water. You have a rule that on certain gradients a driver should have more than half a gauge-glass of water, and that when descending grades of any kind he must take care that the water can always be seen in his gauge-glass? Under the circumstances under which these engines were being worked, it was found necessary to keep up the supply of water in the gauge-glass. It was a large machine, and as such required a plentiful supply of water.

Mr.
C. H. Stanger.
26 April, 1892.

Mr.
C. H. Stanger.
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2668. So that it appears that something must have gone wrong with the water in these boilers, or that it would have been unnecessary to issue special instructions about them? I do not know anything in that order that implied that the gauge-glass is not in its proper place. There is not more water specified in the order that you have read than it is necessary to carry in the best locomotive ever built.
2669. *Professor Warren* (to witness).] When you come into the box again I shall inquire further into the subject connected with those returns. I do not think it is fair to press the matter further now.

Mr. Thomas Rhodes Firth, being sworn, said:—

Mr.
T. R. Firth.
26 April, 1892.

2670. *President.*] What are you, Mr. Firth? Chief Assistant Engineer in the Railway Construction Branch.
2671. Where are you stationed? In Sydney.
2672. Are you a member of the Institute of Civil Engineers? Yes.
2673. How long have you been in the Railway Service of this Colony? Since 1860; in the service of the Government since 1863.
2674. Well I want to know how long you have been in the Railway Service? I have been in the Railway Service since 1860, and was connected with railway work for about seven years before I came here.
2675. *Mr. Hoyle.*] Had you charge of the South Coast Line when it was being constructed? As far as Clifton—from Eveleigh to Clifton.
2676. Did you see when the structures were being built along that line that they were to the standard gauge? Yes.
2677. And were they to the standard gauge? Yes, of course they were.
2678. You have no doubt whatever about that? Not the slightest.
2679. Do you know whether any alteration was made to the Arncliffe platform by the Commissioners? Yes, I do.
2680. Have you measured that platform? Yes.
2681. Was it to gauge before these alterations were made? Yes.
2682. Are you sure of that? Yes, I am sure of it.
2683. I want you to be very particular on that point. You are absolutely sure that it was to gauge? I have already said so.
2684. Was the platform at Otford to gauge? Yes, it was erected to gauge.
2685. Have you any gauge to guide you in the structures overhead in the projection of the verandahs, for example, so as to clear the cabs of passing engines? Yes; we had the platform to guide us as to that.
2686. But do you work to a gauge in that case;—is there not a particular distance at which the verandah stands from the line? Yes. We build them a certain distance from the edge of the platform and a certain height above it.
2687. Was the Wollongong station verandah built to that gauge? I know nothing about that. I was not on that part of the line.
2688. Who was in charge of that? Mr. Alexander, I think.
2689. *Mr. Brown.*] What is the gauge? I can give you the figures.
2690. *Mr. Hoyle.*] You will be able to furnish the figures to-morrow, I daresay? Yes, I can get them for the Commission; but it is impossible for me to carry all these details in my mind.
2691. When you are constructing a road have you not a standard to guide you as to the weight of the engines to be run on the rails? I suppose that was taken into consideration when the railway was first projected.
2692. Do you consider that an engine having 15 tons 9 cwt. on her driving-wheels would be a danger to the permanent way—we will say on the Northern Line, where you have an iron rail—a 70-lb. iron rail. Do you consider that an engine with a weight, such as I have described, on the driving-wheel would be in any way dangerous to the permanent way, with a rail of 70-lb. weight? No, I do not think it would be in any way dangerous with the sleepers placed where they are now.
2693. What is the distance of the sleepers? About 2 feet 4 inches; some of them a little closer. The joints are 1 foot 9 inches.
2694. Do you think that an engine and tender when loaded weighs 97 tons? I think the weight is 92 tons.
2695. Well, some of them weigh 92 tons, and some of them 97 tons. The Consolidation engines weigh 97 tons and the passenger engines 92 tons. We will take a passenger engine weighing 92 tons. Do you consider that it would be perfectly safe for such an engine to run over a 70 lb. iron rail at a high rate of speed? Well, I think so; and, as a matter of fact, they are doing it in America now with the same rails and the same kind of engines.
2696. Would not the manner in which the driving-wheels are loaded have something to do with the wear and tear of the road? Yes, certainly; and you may overload them so that it would be dangerous to run on such a rail, but I do not think there is any danger with the present loading. If I was going to employ engines of that weight on a railway I do not think that I should begin by laying such light rails, because I think it would be more economical to have heavier rails.
2697. Do you think, by the continual running of these engines, it would be necessary to employ extra supervision, or to have the road more closely watched than would be the case with lighter engines? Yes; the heavier the engine, and the more traffic on the road, the more supervision is necessary.
2698. Well, would not such an engine as this make it necessary in time for a heavier rail to be used? No; you might lay the same weight of rails again. It is a question of economy. Looking at it from an economical point of view, I think it would be better to renew the lines with a heavier kind of rails.
2699. Then it would not be anything like as economical to run these heavy loads on the present rails as it would on heavier rails? No; I think it would be more economical to put down a stronger road.
2700-1. *President.*] Mr. Firth says that if he were organising a railway, and knew that he was going to get these engines, he would put down heavier rails than they have now, and that he would do so purely as a matter of economy? Quite so.
2702. But if you thought that it was necessary, in order to carry on the traffic, to get heavier engines, you would get them, notwithstanding that you had rails as light as those at present in use? Yes.

2703. *Mr. Hoyle.*] And you think that a 70-lb. road with these engines upon it is perfectly safe? Yes; perfectly safe. Mr.
T. R. Firth.
2704. *Professor Warren.*] That is provided the bridges are strong enough to carry them? Yes; I was speaking about the road though. 26 April, 1892.
2705. Here is a Consolidation engine. Its weight is about 58 tons on the driving-wheels. Would any of our timber viaducts carry that weight. You have had a large experience of timber viaducts, and you know what they would carry. You have eight beams of ironbark. Do you say that they would carry these engines? Yes; they would carry them safely.
2706. But what factor of safety would you have? About three, I think.
2707. And you consider a factor of safety of three safe enough for a timber viaduct? I said that it was safe.
2708. For how long? That would depend a great deal upon the speed, and so on.
2709. Take the Wagga Wagga viaduct? I think it is very probable that if I had these engines to start with I should re-design the bridges.
2710. But taking the Wagga Wagga viaduct, would you run over it with one of these engines at a rate of 10 miles an hour? Yes. I should think it safe to do so.
2711. *Mr. Fehon.*] As a matter of fact, it is not done. The speed is always slackened on that viaduct, and we have money voted to build a new one.
2712. *President* (to witness).] What rate do the engines go over the Wagga Wagga viaduct? I cannot say.
2713. *Professor Warren.*] I know that you have had a good deal of experience with regard to the Wagga Wagga viaduct? Yes; but when I am giving answers to these questions I would prefer to be accurate, and I have not had any time to think over the matter.
2714. Could you not tell us approximately? I would rather think over the matter.
2715. *Mr. Fehon.*] Had not Mr. Whitton two gauges? Yes; I believe the gauge was altered between 1878 and 1880. Mr. Whitton widened the gauge by 3 inches.
2716. *President.*] Had you the work of widening it? Yes, on the new line.
2717. To a new gauge of what? Five feet. There were platforms and station buildings on the lines at the time. I believe the rails were shifted to this new gauge.
2718. Then they did not disturb the building, but they made the difference by altering the rails? Yes. The first place that I was aware of the alteration, was at Wallerawang; I was up there and noticed that the rails had been thrown over 3 inches.
2719. What system were these Illawarra stations built upon? The latter gauge, of 5 feet from the centre of the rails.
2720. *Professor Warren.*] You have already stated that you built these platforms to gauge. There is no use in my asking you many questions about that. It has been stated that the platforms were not to gauge in your district? They are to gauge now.
2721. Of course you set out the ordinary tunnels and the curved tunnels? Yes.
2722. It is a very difficult thing to set out a tunnel compared to the measurement of the platforms and the rails alongside them? Yes.
2723. And you would hardly imagine that the man who could do the one would go wrong in the other? No; the Arncliffe platform was set out with a theodolite.
2724. Do you not think that the real reason is this—that the lines were wrongly measured? The rails are not in their proper line.
2725. *Mr. Hoyle.*] And could the rails have been put back to their proper place instead of the platforms being chipped? Well, it is a question as to what would cost the least money. No doubt the correct thing would have been to put the rails back.
2726. Is it not the duty of an Inspector of the Permanent Way to see that his road is kept to gauge? Yes; it is his duty, but like many other duties it is not always strictly carried out.
2727. We have gangs of men whose duty it is to keep the roads in proper order, and the duty of the inspector is to see that that is done? Yes.
2728. *Mr. Fehon.*] And that is done.
2729. *Mr. Hoyle.*] Then if that is done the evidence that Mr. Firth has given to-day is very important.
2730. *Mr. Fehon.*] Mr. Firth is speaking of constructions not of measurements. (To witness.) I would ask you Mr. Firth, whether, in your opinion, if one of these engines would draw a certain load, and it required two engines coupled to draw a similar load, which would be the more injurious to the permanent way? I should say that the two engines coupled together would be the most injurious.
2731. Although not coming under your official cognisance, are you not aware that the Commissioners since they have been in office have strengthened the permanent way very considerably, and are continuing to do so by putting down 80-lb. rails on the suburban lines, and steel rails in other places, and further that this permanent way is in a much better state now than when it was originally laid down? Yes.
2732. *Mr. Hoyle.*] I would like to ask you this: If two engines are hauling a train, and there is one in front and the other behind, would those engines so placed have a worse effect upon the rails than one large engine? I think they would.
2733. You think that one engine before and the other behind would have a more injurious effect than one engine hauling the whole load? Yes.
2734. Why? Because I think there would be more friction on the rails. When on a curve you have one engine pulling in front, and another pushing behind, that engine behind is trying to thrust the carriages off the curve, and I think the tendency would be consequently more injurious than as though there was only one engine attached to the train. Of course that only applies to a curve. On a piece of straight it would not matter so much.
2735. *Mr. Fehon.*] It is not usual to push up engines except with goods and stock trains, and then it is not a question of hauling. If it was a question of hauling the two engines would be coupled together, and consequently there would be double friction on the lines.
2736. *President* (to witness).] Have you considered this question of the Baldwin engines yourself? No.
2737. You do not know much about that? No; I do not know much about it.

Mr. Stanley Alexander, being sworn, said :—

Mr. S.
Alexander.
26 April, 1892.

2738. *President.*] What are you? A civil engineer.
2739. In the service of the railway of this Colony? I am in the Department of Public Works.
2740. What is your exact position? I am now Examiner of Public Works proposals, but by profession I am a railway engineer.
2741. When you say that you are Examiner of Public Works Proposals, I suppose you mean that in the course of your duties you have to examine places in which it is proposed to construct new railways? Yes, and other public works.
2742. At all events, you consider the routes of proposed railways? Yes.
2743. And how many years experience have you had as a railway engineer? Since 1860 I have been earning my living in the profession.
2744. And have you ever been in the railway service of this Colony, or were you always in the Public Works Department? I was connected with the railways of this Colony for several years.
2745. How long is it since you left the railway service? I left in 1890.
2746. And what was your position in the railway before you left? I was District Engineer.
2747. On what line? On the Illawarra line.
2748. In fact you continued the line from South Clifton to Kiama? Yes.
2749. *Mr. Hoyle.*] Were you the engineer on the South Coast line from South Clifton to Kiama? Yes.
2750. Did the gauge of the platforms come under your observation? Yes.
2751. Were the platforms from South Clifton to Kiama built to a standard gauge? Yes.
2752. But you measured them before you took the line over? I constructed the railway.
2753. And you are sure that whatever buildings were erected when the line was constructed were all to the standard gauge—to the last standard gauge?
2754. *Mr. Brown.*] Is this the same standard gauge that the Commissioners wanted to make throughout the whole Colony? Yes, I think so.
2755. Are there two standard gauges? No.
2756. *Mr. Fehon.*] Mr. Whitton, in the early days of the railway, established a gauge. He found that it was too narrow and established a broader gauge, and that is the gauge that we are altering the platforms to.
2757. *Mr. Brown.*] Then the gauge that this gentleman is speaking about is the gauge that you are bringing your platforms to?
2758. *Professor Warren* (to witness).] Was it 5 feet from the centre of the way to the edge of the platform? Yes.
2759. *Mr. Fehon.*] I think it is 5 feet 1 inch, but I cannot be sure.
2760. *Witness.*] I found at home one of the working plans of the line, if you would care to see it.
2761. *Mr. Hoyle.*] Could we not have a copy of it attached to the evidence? I will put it in if you like.
2762. And when you constructed the Wollongong station did you build your verandahs to gauge also? The plan of the verandah was sent up from Sydney, and I simply carried it out.
2763. But was it made to what is known as the standard gauge for overhead gear? I do not know of the existence of any standard gauge for overhead gear. I only know of three dimensions for the construction of station buildings. The width from the centre line to the edge of the platform, the measurement from the centre line to any fixed structure, such as the pier of a bridge, and the third dimension is the height.
2764. And did you work to those standard measurements on the Wollongong stations? Yes; excepting the height.
2765. Have you no gauge for the verandahs? I never heard of one. There may be a gauge in the office, but I have no knowledge of it.
2766. Would the verandah structures there be of the same projection as all the other verandah structures on that line. Would the dimensions of the verandahs at Wollongong be the same as the dimensions of verandahs on the rest of the line? Not that I know of.
2767. Then there is no fixed standard for that? Not that I am aware of; I simply carried out the plans.
2768. In building the line from Sydney to Newcastle, were the platforms built to the new gauge or to the old gauge? That I do not know; I was not there.
2769. *Mr. Fehon.*] I would ask Mr. Alexander whether the South Coast line was not opened for traffic before a great many of the permanent structures were erected, and whether in consequence a great many of those permanent structures, especially platforms, were not constructed by the Existing Lines Branch? A good many of them were.
2770. They did not come under the department with which you were connected at that time, they actually came under the Commissioner for Railways? Yes.
2771. *President.*] Might they be then of a different gauge?
2772. *Mr. Fehon.*] The Construction Branch of the Service would not be responsible for any error there might be in the platforms if they were constructed by the Existing Lines Branch. The Existing Lines Branch is a branch that takes their work over from the Construction Branch as it is, and does any necessary work after that but in the hurry to open this line, I believe that it was taken possession of by the Commissioner for Railways before it was properly completed by the Construction Branch. Consequently the Engineer for Existing Lines, under the Commissioner, had to undertake the work of building platforms and so on, that ought to have been done by the Construction Branch. Consequently the building of these platforms was not done under the observation of Mr. Alexander at all.
2773. *President.*] But under any circumstances, should they not have been built to a regular gauge?
2774. *Mr. Fehon.*] They should have been, but as a matter of fact we have found that they varied very considerably.
2775. *Mr. Hoyle.*] I would like to call Mr. Midelton as the next witness, and as his evidence will be very long, I should be glad if the Commission would consent to adjourning the inquiry to-day at the present stage, and proceeding with Mr. Midelton to-morrow.
2776. *Professor Warren.*] Has Mr. Midelton examined the Baldwin engines?
2777. *Mr. Hoyle.*] I understand that he has, but as he is here now, you might put him formally in the box.
2778. *Professor Warren.*] Well, we will assume that he has from what you say.
2779. *Mr. Hoyle.*] Well, I might say that I believe he has, from the fact that I saw him in the workshops on one occasion when I was there. I may add that Mr. Midelton has great faith in the Baldwin Company, and knows a great deal about their work.

WEDNESDAY,

WEDNESDAY, 27 APRIL, 1892.

[The Commission met at 2:30, in the Board-room, Colonial Secretary's Office.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

ALEXANDER BROWN, Esq., J.P.

George Cowdery, being sworn, said:—

2780. I was for about twenty-seven years in the Railway Service of New South Wales, in the capacity of District Engineer on the Southern Line from Picton to beyond Mittagong, and on the Zig Zag works and survey works. I was Engineer for Existing Lines subsequently. I worked under Mr. Whitton first. I was Engineer for Existing Lines for about eight years.

Mr.
G. Cowdery.
27 April, 1892.

2781. *Mr. Hoyle.*] Whilst you were Engineer for Existing Lines and when erecting structures on the permanent-way did you work to the gauge? What gauge?

2782. We understand from the evidence already given that there have been two gauges for making the platforms, that is to say, there was a difference of gauge between the platforms and rails; originally we had a gauge narrower than that at present? Yes.

2783. When you were erecting buildings in the construction of the line, as for instance, in making new platforms or pulling down an old station and rebuilding it, did you work to the standard gauge? Certainly.

2784. Can you tell us this, Mr. Cowdery; we understand that the date that the latest gauge now known, that is to say, the widest gauge, was inaugurated was on or about 1880;—is that correct? I cannot tell you, but I can tell you what caused it to be inaugurated, it was in consequence of the American engines that were introduced here. From their first introduction into this Colony we found that they struck against some of the platforms and the roadway had to be widened, that is to say, the rails had to be pulled away from the platform.

2785. You had then to widen the gauge? Yes, between the platforms and the rails.

2786. *Mr. Brown.*] Are you referring to the recent importations of the Baldwin engines? No, to the old Consolidation engines.

2787. *Mr. Hoyle.*] These were the engines brought here when Mr. Midelton was in office? Yes, or when Mr. Scott was in office; I cannot say exactly.

2788. After the alteration of the gauge did you work to it in the erection of all structures? All I put up, certainly.

2789. Are you positive that your gauge was worked too? Yes, I have no reason to think otherwise.

2790. *Professor Warren.*] As Engineer-in-Chief you cannot undertake the duty of checking the work of your officers, they were competent officers, and you had to entrust them with the work? Yes. The reason for the alteration of the gauge was, as I have already stated, on account of the new American engines.

2791. *Mr. Hoyle.*] They were 75-ton engines, I believe? I believe 75 tons was the weight.

2792. But the gauge is not altered on all the lines in consequence of these engines? No, because they were only supposed to work on the Western Line. They were working the heavy traffic there, and we widened the gauges for them. But we did not alter it on the Northern Line, and I do not think on the Southern Line. They were not intended to run in those directions, nor had they run there.

2793. They were meant for the mountain traffic? Yes.

2794. Being strong engines? Yes.

2795. None of the engines subject to these inquiries were in use when you left the service I believe? No, and I do not know anything about them. I have not been alongside one of them.

2796. Evidence has been given that when the Railway Commissioners came into office, and before that, it was found that the platforms were out of gauge, and I now ask you as engineer at the time that I have referred to whether that was so or not? All the platforms I had to do with were not out of gauge.

2797. *Professor Warren.*] You had to do with all the lines in existence at the time, had you not? The engines which are travelling over the Western Lines were still travelling there, and the northern platforms had not been altered to the extreme width to which they have now been put.

2798. *President.*] What platforms did you make? I did not make very many except at new stations.

2799. Can you give me the names of some? I could not.

2800. Have you any idea how many? I have not, it is only about an hour and a half since I received notice that I was to come here. I have not looked up the slightest evidence, it is only from memory that I can speak.

2801. *Mr. Brown.*] Could you tell us the name of one of the platforms?

2802. *Mr. Hoyle.*] Was Petersham one? No; that platform was built before.

2803. *Professor Warren.*] Stanmore was one was it not? No; all the platforms were built on that line before.

2804. But Stanmore—surely you built that? Well, if I did you may depend it was to gauge. The gauge was laid down. On one or two occasions I gave the gauges of all the platforms and bridges to the Locomotive Department.

2805. You never heard of them being out of gauge? No; I supplied the Locomotive Department with the gauges when they asked for them once or twice.

2806. Whilst you were Engineer-in-Chief of the Existing Lines you never received any reports from your officers that the platforms were out of gauge? No.

2807. *Mr. Hoyle.*] Is it possible for the rails through continual traffic to be moved towards the platform? Yes.

2808. Is it not the duty of the inspectors and the gangers to see that the road is kept in proper position and repair? Certainly.

2809. If the road had moved towards the platform would it be right to chip the platform in order to widen the road, or would it not rather be the correct thing to put the road in its place? I think the proper thing to do would be to put the road in its place.

2810. Then you would not go on chipping the platform? Certainly not.

2811. Or you might go on chipping and chipping till nothing remained of the platform? That might be so.
2812.

Mr.
G. Cowdery.
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2812. The gangers are to be on the road to keep everything in gauge, and keep everything in line;—the inspector is at the head to carry everything out in connection with the lines? Yes.
2813. Do you know the weight of the Baldwin engines? No.
2814. The Baldwin passenger engines when loaded are 92 tons with 15 ton 9 cwt. on their driving wheels, and the Consolidation engines are 97 tons.
2815. Now I want to ask you whether in your opinion, as an engineer, it would be perfectly safe for any of these engines, weighted as they are on their driving wheels, to be run at a high rate of speed over the permanent-way on a 71-lb. iron rail? Well that depends a good deal on the bearings of the rail. It depends upon how many bearings you have.
2816. *Professor Warren.*] Sleepers you mean? Yes.
2817. I suppose you refer to the spacing between the sleepers—that is the distance between them? Yes.
2818. *Mr. Hoyle.*] Well, take for instance on the Northern Line where they are 2 ft. 8 in. to 3 ft. apart, would it be safe to run these engines with that weight on their driving wheels, say at 35 miles an hour, that is to be perfectly safe on the permanent-way? I daresay it may be safe for a certain time, but it must be said that when these lines were laid down they were laid down for a much lighter engine than is now running over them.
2819. *President.*] We all know that these new engines are very much heavier than those we have had here, and we now want to know if it is unsafe for these heavier engines to go over 71-lb. rails? Well I would not say that until I went into the calculations carefully.
2820. *Mr. Brown.*] You would not venture an opinion now but you want to consider it? Yes.
2821. I think it is very important from your point of view that you should consider it.
2822. *To Mr. Hoyle.*] Just state the points on which you want information.
2823. *Mr. Hoyle.*] Suppose I were to read my charge in that respect.
2824. *Mr. Brown.*] No I do not think that would be of much use.
2825. *President.*] I think it would be better to ask him directly for the information we want.
2826. *Professor Warren.*] Suppose you write the question out.
2827. *President.*] I think this question is the very gist of your case;—do you want to ask him any more questions?
2828. *Mr. Hoyle.*] I want to know from Mr. Cowdery whether he, as an engineer, would consider it safe for engines of this kind, weighted as they are to run over our permanent-ways laid with rails of 71 lb. weight? I should want the weight of the engines and the length of the wheel base.
2829. *Professor Warren.*] Do you think it would be better to put the question in writing?
2830. *Mr. Hoyle.*] Very well; I shall post it to you to-morrow night, Mr. Cowdery.
2831. *Mr. Brown.*] These questions will be furnished to you by Mr. Hoyle and you can send us the information later on.
2832. *President.*] Is there anything else Mr. Hoyle that you wish to ask this witness?
2833. *Mr. Hoyle.*] I should like to ask him something about the bridges.
2834. *Witness.*] I should like to say something about these also. There was something said at a previous Royal Commission about the cross-girders, these girders were considered to be none too strong. For my own part I think that they should be seen to, but I do not wish to say anything more about it.
2835. *Professor Warren.*] I should like to ask a question about the bridges, because I know that is a matter requiring consideration, and therefore I have asked for a tabulated statement.
2836. *Witness.*] I was very much interested in the question at one time, the engines have increased considerably in weight since these bridges were erected, and there should be more attention paid to them. There has been no attention paid to them so far as I am aware.
2837. *Professor Warren.*] You know the Wagga Wagga viaduct and the tests which have been made with regard to it;—do you consider it safe to run engines of 97 tons weight on a bridge with a girder of 29 ft. 6 in. span, such as this viaduct has;—would it be safe? I never dreamt for a moment that viaducts such as that at Wagga Wagga were not safe; it was only the notion I had in my mind.
2838. But these engines are much heavier in weight than they were in your time? Yes. Of course, I never liked these bridges, and I do not care to say too much about them. In trying the deflections of the timber girders it must be remembered that when they get old they will not deflect as much as when they were new. They get a set on them, and the more set they get upon them the worse they are.
2839. *President.*] Do you mean the less work they get to do the more dangerous they become? No; the less deflection there is the more rigid they become, consequently the more dangerous they are.
2840. *Professor Warren.*] The Wagga Wagga viaduct is a type of the others, and it was made by the Railway Department some years ago—these viaducts were of two kinds, one of 29 feet 6 inches and the other 26 feet, I believe? Yes; they were 29 ft. 6 in. spans, I believe.
2841. *Mr. Brown.*] We have evidence that the engines go over these viaducts at a moderate rate of speed? It was recommended against my advice that they should travel over them at full speed.
2842. *President.*] But evidence has been given that since the Baldwin engines arrived they were ordered to go at a less rate of speed;—would that make any difference in your calculations;—is it dangerous to take one of these engines over the viaducts at the rate of 5 miles an hour? No; the deflection would be about the same at a fast rate as a slow one.
2843. *Mr. Fehon.*] The Baldwin engines have not gone over the Wagga Wagga viaduct.
2844. *President.*] They have not run over it, you say? No, sir; they have not been used for that purpose.
2845. Have they been used for running over any similar viaduct? They have had to travel over the Penrith viaduct; they have had to travel over that to get up west where they are being used.
2846. Well, have they been over that;—is it the same as the Wagga Wagga viaduct? I cannot say personally.
2847. *Professor Warren.*] The only difficulty is in the span of these viaducts; in the one case it is 29 feet 6 inches, and the other 26 feet. The Wagga Wagga viaduct is a type of viaduct that is used very largely in this Colony. No doubt the Baldwin engines have been over many of them at Penrith, and on the Southern Line and on the Northern Line. (*To witness.*) You have not considered the question with regard to the increased weight of the Baldwin engine? No. I made up my mind that I would not interest myself in them, and do not know the weight of the engine.
2848. With regard to the other bridges, taking into consideration their spans, you have not considered the effect upon them for heavily-weighted engines passing over?

2849. *Witness.*] Something was said on the old Commission about the Penrith bridge and the cross-girders.
2850. *Professor Warren.*] The greatest weight on the wheels of any of the old engines on the lines in your time was 16 tons, I believe—I refer to the suburban tank engines, so that there is not such a great difference between the 15-ton Baldwin engine and the engine referred to? Well, I think there is more traffic on the bridges, and they get more wear and tear, and should be looked after more closely.
2851. *President.*] But are they not looked after? I do not know.
2852. *Professor Warren.*] Then, there is no reason to look after the cross-girders in the bridges with the Baldwin engines any more than with the tank engines in your time? Except that there is an increased rate of speed, and there are more of them going over the bridges.
2853. *President.*] If they were looked after in your time, why not now? I do not know that they are not. The rolling-stock, I think, may be increasing in weight and number without a corresponding increase in the strength of the bridges and roads.
2854. That has been going on for a long time? Yes; for years.
2855. *Mr. Hoyle.*] Considering that the witness is not prepared to express any further opinion on this subject, I have no further questions to ask.
2856. *President.*] Mr. Hoyle will post to you some questions he would like to ask? Very well; my address is FitzEvan Chambers, Castlereagh-street.

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John Hordern, being sworn, saith:—

2857. I am a driver on the railways of New South Wales, driving from Bathurst to Sydney. I have been doing that about nine years and nine months. I have been in the railway service about eleven years. Before I was driving I was firing.
2858. *Mr. Hoyle.*] Are you driving one of the Baldwin engines, Mr. Hordern? Yes.
2859. What is the number of that engine? No. 450.
2860. Will you state your experience of these engines? My experience of these engines is that I have found, since I had anything to do with them, every satisfaction. I have had every satisfaction from them as a driver.
2861. Have you found any of the parts defective? I have had one or two slight accidents.
2862. *President.*] What do you mean by slight accidents, do you mean breakages? Yes; I had a couple of valve yokes break.
2863. Have you had any mishaps with the reversing-gear? I have had one of the pins of the reversing gear break.
2864. Which one? The back pin.
2865. Have you had any failures with the brake-gear? Only a slight one, a five-eighth bolt became displaced. That is the only failure I have had in brake-gear.
2866. Have you had any draw-hooks break in these engines? One about six months ago.
2867. On these engines, I mean? No.
2868. *Mr. Brown.*] We are talking only about these recently imported engines?
2869. *Mr. Hoyle.*] Was the failure to the reversing and brake gear caused through rough handling? No; I do not think it was.
2870. In using your reversing-gear, did you set it with proper precautions? Yes; as a matter of fact, I was not setting it at all on this occasion, because I was coming down an incline.
2871. *Professor Warren.*] And at the time it broke, you were not handling it? No.
2872. Was it through the careless application of the brake or did you exercise the care, that with the experience of a driver, you should exercise? Yes.
2873. Then it was not through the application of the brake at all that this pin came out? No; it simply came out from the motion of the engine.
2874. *President.*] Do you mean that it shook out? Yes, sir; the split cotter broke, and the pin worked out.
2875. *Mr. Hoyle.*] When you are coming down a bank with this engine—dropping down a bank as it is called in technical language—do you find that she rolls very much? No.
2876. Do you find it come down as steadily as other engines? Yes; quite as steadily.
2877. Have you every control over this engine? Yes; every control.
2878. So the brake on the engine is perfectly well able to control it at any rate of speed?
2879. *Professor Warren.*] Irrespective of the weight of the train behind? Yes; as a rule I do not use the tender brake on the train.
2880. Are you speaking of the passenger or goods train? I am speaking of passenger driving.
2881. What is the average load you haul? About seventeen and a half carriages.
2882. Averaging from 8 to 10 tons? Yes, averaging (say) 10 tons.
2883. *Professor Warren.*] Where do you haul that load? From Penrith to Katoomba.
2884. At what speed? Averaging about 18 miles an hour.
2885. When you are going up the hill—taking the Lapstone Zig-zag—do you find much jerking on the engine? No.
2886. It is a steady pull? Yes, a steady pull.
2887. Have you examined these engines minutely in any way? Yes; I have examined them so far as my capacity as a driver goes.
2888. *Mr. Hoyle.*] That is to say you go round your engine when you come to the depôt to see that all is right? Yes.
2889. Have you found any defects in the wheels? No, I have not found any.
2890. You are referring to this engine only? Yes.
2891. *Mr. Brown.*] You have driven two or three engines of the Baldwin Company, I believe? Yes.
2892. *Mr. Hoyle.*] Do you remember their numbers? They are numbered 448, 454, and No. 450.
2893. Driving No. 448, had you any breakages with her—did you find her rolling when she was dropping down a bank? She did roll a little more than my own engine, but very little.
2894. There was no danger in that roll? No; I do not consider that there was.
2895. What was your experience of engine No. 454—were there any breakages on her whilst you were driving her? No, not whilst I was driving her; I had her only for a trip.

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2896. Was that all;—how long had you No. 448? I had 448 for two trips.
2897. How long have you been driving No. 450? I should say about four months, but I cannot tell exactly to a day. I think it would be four months, however, since I got that engine.
2898. What service did you take? The mail and passenger service.
2899. Is 450 a passenger engine or a Consolidation engine? She is a passenger engine.
2900. You have taken seventeen and a half carriages from Penrith right through up to Katoomba with this engine? Yes, from Penrith, without a pilot.
2901. Did you use any of these engines for the mail, and did you want any assistance with them on those occasions? On one trip I had an assistant pilot engine, but I had a very heavy load then. On that trip I had nineteen and a half carriages.
2902. *Professor Warren.*] You had another engine to pilot you then? Yes, I had assistance to Katoomba to help me on. The time-table had been accelerated, that was the reason why I had to get the pilot. I had twenty-three carriages up from Wallerawang, and that was up a grade of 1 in 40, and round a 12-chain curve.
2903. Did she pull all right? Yes.
2904. And keep time? Yes.
2905. What is your time-table time;—about 18 miles an hour, is it not? Yes, sir, that is about it.
2906. From where? From Wallerawang to Eskbank, a distance of 10 miles. There is a very heavy curve there.
2907. What is the grade? 1 in 40.
2908. How much is there of it? About $3\frac{1}{4}$ miles of that grade.
2909. Have you any idea of the rate which you went up the Bank? No; I cannot say exactly what speed I went up that Bank at, but I should think that it was about 12 or 15 miles an hour.
2910. You cannot say exactly;—you were more concerned about getting the load up, I expect? Yes.
2911. *Mr. Brown.*] You did the mail time through—you did your time-table time? Yes.
2912. As a matter of fact these engines have given you every satisfaction in every sense of the word? Yes.
2913. And you are well satisfied with them as a driver? Yes.
2914. *President.*] With regard to the reversing-gear and this pin giving way, was that a pin that came out whilst you were using it? No; it holds the screw up to the boiler. There is a bracket on the side of the boiler, and this pin is screwed into the bracket and holds the reversing-screw.
2915. Is that a very serious thing to happen? It causes a serious delay.
2916. Is it a dangerous thing? There is no danger attached to it.
2917. Have you ever had to do with the driving of new engines before this one? Yes; I have.
2918. Are there more things to be put right in these engines than in other new ones that you have had to do with? No, not that I am aware of.
2919. Not necessarily? I do not find it so as far as my experience has gone.
2920. You do not find that there are more of these little things going wrong in these new engines than in other new engines that you have had to do with? No; I do not really think there are.
2921. As compared with others they are a great deal stronger in hauling power, I believe? Yes; very much stronger. There is a difference of three and a half carriages in the amount of weight that they will haul.
2922. *Mr. Hoyle.*] Do you receive 1s. a day extra for driving these engines? Yes; I received 1s. a day extra, but I do not know that it is for driving these engines or what it is for.
2923. Is it a fact that the drivers employed in driving all these Baldwin engines have got 1s. a day extra since they first had charge of them? I do not know. I cannot say of my own knowledge, and I do not rest upon rumour.
2924. Well, have you got 1s. a day more? I was told that I was to receive 1s. a day extra, but I was not informed what I was to receive the additional remuneration for.
2925. *President.*] And you did not bother about it? Well, it did not concern me why I got it so long as I did get it.
2926. *Mr. Fehon.*] I noticed that in talking of a weighted carriage you said it was about 10 tons, that it was calculated at 10 tons to the carriage; do you know exactly the weight at which it is calculated;—what is the Departmental rule in calculating the weight? Well, a few years back we had a circular issued to the effect that the loads were to be calculated for a single carriage at the rate of 8 tons, allowing 2 tons capacity for the passengers who were supposed to be in them.
2927. The 8 tons is extra to the passengers in the Departmental calculation;—the standard is fixed simply for the purposes of calculation, but that is the fixed rule? Well, I was not aware of that.
2928. *President.*] He says that he had seventeen and a half carriages behind his engine on one occasion, and instead of multiplying that by ten it is really eight times that number of tons for the purpose of ascertaining the total number of tons carried.
2929. *Professor Warren.*] Yes, more or less; of course there is an element of uncertainty in the number of passengers.
2930. *Mr. Fehon.*] There is no actual rule except in making a calculation of what the engines could draw, and in that case we would base the calculation upon 8 tons per carriage. If it is a lavatory carriage we should reckon it at the rate of three times 8 tons.
2931. *Mr. Brown.*] I should think at times when you packed the Northern carriages there are about 20 tons in them.
2932. *Mr. Fehon.*] At Easter time, I dare say.
2933. *To Witness.*] Have you ever driven an engine that would give you more satisfaction than the one you now have? No, sir.
2934. *President.*] The engines you drove before were English engines—were they Mogul engines? Yes, sir; they were very good engines for the size of them, but they are not now capable of dealing with the traffic we have on our lines.
2935. *Professor Warren.*] When you say that you never drove an engine that gave you more satisfaction, do you mean that you have never driven a more powerful engine—it is a question of power is it not? Yes.
2936. *Mr. Fehon.*] And as I take it, you have never driven an engine that has enabled you to keep your time so easily? That is so, sir.

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2937. *Mr. Hoyle.*] Have you ever driven a Scotch Yankee over the mountains? Yes.
 2938. And with what results? With very good results.
 2939. What load did you haul? Thirteen carriages.
 2940. Did she go all right? Yes.
 2941. That is the maximum load—could she carry anything more? No, not to keep time.
 2942. *Mr. Fehon.*] The pin you spoke of, and other small mishaps will occur in any other new engine, would they not? Yes; I have driven the engine for four months, and I have not had a brake block put on yet.
 2943. *Professor Warren.*] I would have liked to ask Mr. Fehon whether he would supply the profile referred to in the letter of the 15th December, 1890. I have been looking in the *Railway Gazette* this morning, and I cannot find it. The Baldwin Company referred to it in their letter to the Railway Commissioners. They say that the profile is a theoretical one, and they give it to you. As a matter of fact, was it sent.
 2944. *The Secretary to the Railway Commissioners.*] I think it was sent. I think I have seen it.
 2945. *Professor Warren.*] They give figures, but it would be much better to have a theoretical profile before us.
 2946. *Mr. Fehon.*] We have one, I think. I think this has reference to the Baldwin engines.
 2947. *Professor Warren.*] On the Baltimore and Ohio railways?
 2948. *Mr. Fehon.*] Yes; I think it is a blue print, hanging in Mr. Eddy's room.
 2949. *Professor Warren.*] In a letter from R. Towns & Co., dated Sydney, 15th December, 1890, they say:—"Have never had maximum load weight taken up 17-mile grade by 1300 class engine. It is about 240 net tons at schedule speed of 22 miles per hour, exclusive of weight of engine and tender. The 240 tons of 200 lb. are equal to 214 tons of 2,240 lb. There is much curvature on the 117-foot grade, and we are informed that in some places the actual grade considerably exceeds 117 feet per mile. The latter is the theoretical grade as shown by the profiles."
 2950. I think you must have that, and I hope you will try to find it. I could not find it myself in the *Railway Gazette*.
 2951. *Mr. Fehon.*] The engines are doing very much better than is stated in that letter.
 2952. *President.*] Call the next witness.
 2953. Mr. Midelton was called, but was not present.
 2954. *President* (to Mr. Hoyle).] Have you any other witnesses ready for us to examine whilst we are waiting for Mr. Midelton?
 2955. *Mr. Hoyle.*] No; I thought that Mr. Midelton would have been present, but he is not. [*A messenger was despatched for Mr. Midelton.*]
 2956. I think it would be desirable for the Commission, in the absence of Mr. Midelton, to examine the wheels of the engine at Eveleigh. I refer to the wheels that are defective in the Baldwin engine, No. 456.
 2957. *President.*] Can that be done in an hour, Mr. Hoyle, while we are waiting for Mr. Midelton?
 2958. *Mr. Hoyle.*] Yes, I think so.
 2959. *Mr. Hoyle.*] Mr. President, in view of the terrible accident that has happened this morning on the Western line, and which I exceedingly regret—in view of that accident and of certain things which appeared in the newspapers to-day in reference to it, I desire to ask the Commission to adjourn until Tuesday next, in order to enable me to view the scene of the accident, and collect any evidence I may be able to collect upon the subject. This is a very serious accident, and if the reports are true that have appeared in the newspapers to the effect that the bursting of the rail had something to do with the cause of the accident, it would be a very important matter in connection with this inquiry. I would, therefore, ask that in view of these facts, the inquiry may be adjourned from its rising, this afternoon, till Tuesday next, at 2 o'clock.
 2960. *Mr. Brown.*] I have no objection.
 2961. *President.*] The Commission accedes to your request, Mr. Hoyle.

[The Commission, accompanied by Mr. Fehon, Mr. Stanger, Mr. Hoyle, M.P., and other gentlemen, then proceeded to the workshops, at Eveleigh, where they made a careful examination of Baldwin engine No. 447, and also of the wheels originally made for but now detached from Baldwin engine No. 456. The Commission also inspected one of the new engines recently manufactured for the New South Railways, by Messrs. Beyer and Peacock, of Manchester, and which was then about to proceed with the southern express to Albury. Draw-gear, and locomotive wheels of various makes and descriptions were examined, and the blacksmith shop was visited. The Commission returned to the Colonial Secretary's Office too late in the afternoon to hear further evidence, and Mr. Midelton being present was informed by the President that his examination would be conducted on Tuesday afternoon, the 3rd May, at 2 o'clock.]

TUESDAY, 3 MAY, 1892.

[The Commission met at 2 o'clock, in the Board Room, Colonial Secretary's Office.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

ALEXANDER BROWN, Esq., M.L.C., J.P.

2962. *Mr. Hoyle.*] Previous to calling Mr. Midelton I desire to ask if the Commission will procure a copy of the depositions taken at the inquest upon the bodies of those persons who were recently killed in the railway accident at Tarana.

2963. *Mr. Brown.*] For you?

2964. *Mr. Hoyle.*] Yes.

2965. *President.*] I do not know that we could get them for you; but before going any further I think it would be well if one of the Railway Commissioners were present.

[*Mr. Fehon having entered the room.*]

2966. *President.*] Mr. Fehon, before you entered an application was made to the Commission by Mr. Hoyle for a copy of the depositions taken at the recent inquest held at Bathurst on the Tarana railway accident.

- accident. I do not know whether Mr. Hoyle would be entitled to them, but they could, I should think, be got for the Commission, and then of course the Commission would lend them to him. Do you think you could procure a copy of these depositions for us?
2967. *Mr. Fehon.*] I think so.
2968. *President.*] There is no objection on your part then?
2969. *Mr. Fehon.*] Oh no, not at all.
2970. *President.*] Very well. Then I suppose the Department of Justice will supply this information?
2971. *Mr. Fehon.*] Yes, I think the Department of Justice will supply it.
2972. *President.*] We shall then, I suppose, have to write for them, as I hardly think we can get them at once?
2973. *Mr. Hoyle.*] I would also request Mr. President that the rails which were broken in the accident should be brought here.
2974. *Mr. Brown.*] There is no objection to that I suppose Mr. Fehon?
2975. *President.*] If they could not be brought here, perhaps we could go to where they are?
2976. *Mr. Fehon.*] There are only the two rails.
2977. *Mr. Hoyle.*] There are only two. They were produced at the inquest at Bathurst, and I think there can be no reason why they should not be brought here.
2978. *President.*] With regard to their being brought here Mr. Fehon, would there be any difficulty in the way. Of course the rails are, I suppose very heavy?
2979. *Mr. Fehon.*] The rail has been subjected to tests since it was brought here, and is now in several pieces.
2980. *President.*] The fracture I take it has not been touched?
2981. *Mr. Fehon.*] The fracture remains untouched. The rail was marked at each end of the fracture with a band of paint, so as to distinguish it from any other part.
2982. *Mr. Brown.*] Was it not unwise on the part of the Commissioners under the circumstances under which this inquiry has been held to have anything done to the rail at all?
2983. *Mr. Fehon.*] I do not see that sir. At the inquest it was found that the immediate cause of the accident was the broken rail, and the Commissioners accordingly wished to satisfy themselves with regard to this rail.
2984. *Professor Warren.*] I understand Mr. Fehon that you have tested a portion of the whole rail, but did not touch the fractured part?
2985. *Mr. Fehon.*] The original fracture is not touched at all, and the tests that have been applied will not interfere with the present inquiry, it simply means that instead of having a rail 20 feet long you will have a shorter piece.
2986. *President.*] In the condition that it is now in could it be brought here?
2987. *Mr. Fehon.*] Oh yes, it is quite possible to bring it into the room.
2988. *President.*] Perhaps we could see it in the workshop?
2989. *Mr. Fehon.*] Yes.
2990. *Mr. Hoyle.*] I must express my deep regret, bearing in mind the direction of the coroner of the jury at the inquest, that the rail has been touched at all. I think that the coroner in addressing the jury said that there was another tribunal sitting to inquire into the question of the weight of the Baldwin engines, and that the jury should dismiss from their mind any question concerning that matter when considering their verdict. I think the rails should have been left as they were, and no test have been made until this Commission had an opportunity of viewing them and taking evidence upon them.
2991. *President.*] In the first place the Commissioners did not know that they would require to be seen by this Commission, and we are not at all certain that we would require these rails to be viewed, and in the second place they have done nothing that would prevent the fracture from being seen. It was wise, surely, under the circumstances that they should test the rail, in order to discover if possible the cause of the defect.
2992. *Professor Warren.*] Was it the bending test?
2993. *Mr. Fehon.*] No, the drop test. I would point out Mr. President that the Commissioners have a duty to the country to perform in the management of the railways, and if we consider it desirable to test a rail or anything else, we shall do it independently of Mr. Hoyle or anybody else. It is in the interests of the Railway Department that we take this course. One would think from what Mr. Hoyle has said that something had been done to conceal this matter from the Board. Nothing of the sort. This is a most open Board, and we are doing everything we can to promote the fullest investigation.
2994. *Professor Warren.*] We have nothing to do with that Mr. Fehon.
2995. *Mr. Fehon.*] I say this because a wrongful impression might go out through the Press.
2996. *Mr. Hoyle.*] I must call your attention Mr. President that I am from time to time subjected to insult at the hands of the Railway Commissioners. I make no imputations against the Railway Commissioners, and I do not make this statement and request with any desire that I should place the Commissioners before the public in any bad light. What I am doing I am simply carrying out from a sense of duty, and so far as I am concerned in this inquiry I shall do my duty in spite of the Commissioners.
2997. *President.*] There cannot be any harm done to these rails I should think from what Mr. Fehon has said.
2998. *Mr. Fehon.*] There is no harm done to them.
2999. *President.*] The Commissioners have taken a piece of the rail and subjected it to a test, and that, under the circumstances, I should think a very wise proceeding. They have taken a piece of this iron and applied some test to it. Where the break appeared it was left entirely intact, and I do not see how any harm can have been done by testing the rest of it.
3000. *Mr. Brown.*] I think it injudicious on the part of the Commissioners to have interfered with the rail at all.
3001. *Mr. Fehon.*] There were some miles of the same road that is laid with the same kind of rail, and we wished by testing this rail to ascertain what the state of the road was.
3002. *Mr. Brown.*] This accident has added seriously to the responsibility of the Commission, and for that reason, apart from any other, I wish it had never occurred, but since it has, and since the responsibility is thrown upon the Commission, I am prepared to meet it, and I think it would have been quite as well if for the sake of forty-eight hours longer the Commissioners had left the rail alone, so that it could have been seen intact by this Commission.

3003. *Professor Warren.*] Perhaps when the rail with the original fracture is brought here the parts of the rail you have tested what you have done will turn out to be of no sort of importance.
3004. *Mr. Fehon.*] The fracture which occurred at the time of the accident is just as intact now as when it occurred, but we desire to test the rail for other causes besides those which are stated to have caused the accident.
3005. *President.*] Can the rail be brought here?
3006. *Mr. Fehon.*] Yes, it can be brought here.
3007. *Mr. Hoyle.*] I wish both rails to be brought here, there were two rails broken.
3008. *President.*] Is it practical to bring the other rail here also.
3009. *Mr. Brown.*] Can we see it just as well at Redfern as here, or do you want to call evidence with regard to it, Mr. Hoyle?
3010. *Mr. Hoyle.*] Yes, I want to examine witnesses with regard to it.
3011. *Mr. Fehon.*] One rail was the cause of the accident, and the accident caused the breakage to the other rail.
3012. *Professor Warren.*] Mr. Fehon, when I was at Eveleigh, I saw the indicator-gear on a Baldwin engine. Do you propose to make any tests to that engine, because I cannot understand you fitting indicating-gear on to an engine, unless you propose to make tests with it.
3013. *Mr. Fehon.*] Yes, I think it was proposed to make tests with a Baldwin engine, and whilst this engine was under repair it was thought desirable to fit it up with a gear in order to make these tests.
3014. *Professor Warren.*] I think it most desirable. Who will make the test?
3015. *Mr. Fehon.*] Some of our people would be present. We are not particular as to who may be present with them.
3016. *Professor Warren.*] Is it a test in which I could see the arrangements which have been made beforehand, and confer with Mr. Thow beforehand upon them, and as to what tests should be made?
3017. *Mr. Fehon.*] Yes, it is most desirable that you, as a scientific member of this Board, should have every opportunity of knowing what is to be done.
3018. *Professor Warren.*] I think Mr. Thow and I might agree as to what arrangements should be made, and what tests should be undergone.
3019. *Mr. Fehon.*] We shall agree to whatever you and Mr. Thow arrange.
3020. *Mr. Hoyle.*] Will these tests be made as originally proposed by Professor Warren, and the other engines also be tested?
3021. *Professor Warren.*] I do not think it at all necessary to test the Mogul engine, because I do not see what that would do for us. It would appear possibly that this is a much heavier engine. The only engine that could compare with the Baldwin engine is the one we looked at at the works, and which is a heavier engine, but within about 4 tons of the Baldwin passenger, and it would be a very nice and desirable thing to do, to test that engine in comparison with the Baldwin, but I take it that matter is left over until we have heard the Commissioners' evidence.
3022. *Mr. Fehon.*] We have no objection to any tests you may desire to put the Baldwin engines to, but we do not see the necessity of running one kind of engine against another kind.
3023. *Professor Warren.*] I think it would be best first of all at all events to make a test of the Baldwin engines, and the results of that may indicate what further tests may be required to be made. We may be satisfied with it, and think nothing further necessary.
3024. *Mr. Fehon.*] We can give you information with regard to all the classes of engine.
3025. *Professor Warren.*] I do not desire to do anything further than is absolutely necessary, but if I did not see that all I considered necessary was done then I would not be carrying out the work I am here to do.
3026. *Mr. Hoyle.*] The strong reason I have for making these tests is this, that we have had paragraphs in the press as to what the Baldwin engines were going to do, and I think it fair to test the strongest engine we have against the Baldwin engine, and I would suggest the Mogul (or Scotch Yankee) pressed up to 160 lb., and put her on the mountains against the Baldwin engine on a trip from Sydney to Katoomba.
3027. *Mr. Fehon.*] I must protest against any such business as the running of one engine against another. There is nothing to be gained by it except the gratification of personal ends, I will not say by Mr. Hoyle, but by other persons. So far as this inquiry is concerned we shall afford every facility necessary to make these running tests for the Baldwin engines, but any tests with the object of running one engine against another we shall object to, unless the Commission itself thinks it necessary.
3028. *Mr. Hoyle.*] I think we ought to take the strongest engine before the Baldwin engine came, then take the English engine and the Baldwin, comparing their performances, each carrying the same pressure. That is my idea.
3029. *Professor Warren.*] We must not compare the Midelton engine with a Baldwin, because it is obviously not able to do the same work. It is not fair to expect it to do it, and the comparison would lead to nothing, but when you come to put it as a matter of comparison in a test with another engine built for the same purpose and the same traffic, it would, I think, be a desirable test.
3030. *Mr. Brown.*] I think before making these tests the best course would be to get to the close of the evidence, and then Mr. Hoyle could make fresh application, and the Commission could decide upon it.
3031. *Mr. Hoyle.*] Very well; I shall take that course.
3032. *Mr. Fehon.*] I would ask that Driver Moses, who is an important man, engaged in running the Western mail, may have his evidence taken before Mr. Midelton, if Mr. Hoyle has no objection.
3033. *Mr. Hoyle.*] Well, since I called Driver Moses certain things have happened, and that is why I asked for the depositions, in order to examine him on what he stated there.
3034. *Mr. Brown.*] You do not want him now?
3035. *Mr. Hoyle.*] No, I do not want him now; but I will not say that I shall not want him to-morrow. At the present juncture I do not feel justified in examining this witness.
3036. *Mr. Brown.*] Could you not let the man go back to his work, and then if you want him send for him.
3037. *President.*] Do you want all the depositions or only the depositions of Driver Moses?
3038. *Mr. Hoyle.*] I want all of them.

Thomas Midelton, being sworn, said:—

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3039. I am a mechanical engineer, and have been in the service of the Railway Department of New South Wales since 1880 up to the present time. In my opinion, I am still in the service of the Railway Department of this Colony. I am a member of the Institute of Mechanical Engineers, and also of the American Master Mechanics Association.

3040-1. *Professor Warren.*] That corresponds with the Institute of Mechanical Engineers in England? Yes.

3042. *President.*] Were you Mr. Thow's predecessor? Yes. I was appointed by the Governor and Executive Council in May, 1888, as Locomotive Engineer, and was duly gazetted, and, up to the present, that appointment has not been reversed so far as I know.

3043. So you are in the service up to this day? Yes; that is my contention.

3044. Your position you mean;—your contention I take it is that you ought to get the pay? Yes. I contend that I am still appointed, and have been since I was suspended by the present Commissioners, with whom I contend that I have not had fair play.

3045. You have had some difference with the Commissioners. I am not saying that there has been any bitterness of feeling, but there is, I understand, a difference of opinion between you? Exactly.

3046. *Mr. Brown.*] Did you not accept a lump sum of £1,500 so far as the service was concerned? I was offered a lump sum.

3047. But you did take the money? Yes.

3048. What other position did you fill besides Locomotive Engineer? I was Superintendent of the Tramway Department two and a half years. I entered the service in 1880 under Mr. Burnett, the Locomotive Engineer at that time.

3049. *President.*] Had you any appointment in England before you came here;—perhaps it would be better if you gave the Commission a complete account of the whole of your past experience? Yes; perhaps it would be better. Well, I served my time on the Great Western Railway, under Mr. Daniel Gooch and his brother William, for five years, and I worked through the shops; got the best experience it is possible to have. I then left and went to London, and the next step was a job on the Great Eastern Railway as a mechanic in the shops at Stratford; then I was asked by Mr. Gooch to go to the Vulcan Foundry as draughtsman; then I went back to London again, and became foreman of the shop I had worked in. On the Great Eastern Railway I had charge of the running repairs of 152 engines, twenty-two of which were under repair constantly. Shortly afterwards I was asked to accept an engagement on the Isle of Man Railway, and one of the directors connected with it happened to be Chairman of the Tasmanian M.L. Railway Board also, and he asked me to go out there. I went there under agreement, and I had the full authority of the Board of Directors to put the Engineering Department in a proper condition. I remained there for two years performing my duties, when I got into a little trouble with the manager on account of his ideas of things differing from mine. I asked him to get instructions from the Board to alter the conditions under which I came from London, but that did not take place, and there was further disagreement between us, and consequently I left that service. Mr. Burnett, who was Locomotive Superintendent of the New South Wales Railways, asked me to stay in this Colony, and Mr. Scott, his assistant, also asked me to do so. Mr. Burnett promised me the position of chief assistant to himself. Subsequently, Mr. Burnett was suspended, and the appointment I was promised I did not receive. I then worked as a draughtsman until April, 1882, when I was made assistant to Mr. Scott, who was made chief, and I worked in that capacity until 1885. I acted for him and Mr. Downe whilst they were in England and America. I took both appointments, and received £100 (as a recognition of the satisfactory performance of these duties) from Sir Alexander Stuart, and a letter of thanks from the Commissioner of Railways for the admirable way in which I had carried out my duties in the absence of these gentlemen. In 1885 I was suspended on charges made against me by Mr. Scott. These charges were examined, and I received the greatest fair play with regard to them. I showed cause, and after fourteen months was reinstated at higher pay. I was given charge of the tramways, and subsequently I was appointed Locomotive Engineer. I served under Mr. Goodchap five months, and under the present Commission also for five months, then I was summarily removed, and I have done nothing since.

3050. *President.*] Did they give you any reason for your removal? None.

3051. *Mr. Hoyle.*] Whilst you were in the service had you any experience of the Baldwin motors? Yes.

3052. Is it a fact that whilst you were Locomotive Engineer you advised the purchase of the Baldwin locomotives? In 1883 we were very hard up for engines, and the English manufacturers were asked to build for us, but they could not do so in time, and an order was sent by Mr. Scott, on my advice, I think, to the Baldwin Engine Company for ten engines to my specification. Is that what you allude to?

3053. I believe you were pretty favourable to the Baldwin engine? Yes, I believe in American engines. I have, I believe, been the only man in the Department who has upheld the design of the American engines.

3054. *Professor Warren.*] Did you consider them in design better than the English ones? Yes; I consider them better in many respects,—I mean with reference to the road and themselves.

3055. Given a road such as we have with our railways, do you think that the American engine is better than the English engine? I should say that the American engine, if it is a good machine on a bad road, is certainly a better machine on a good road.

3056. That is to say, that the American engine would perform better on a good than on a bad road? Yes.

3057. What do you consider to be the essential difference between the type of the English engine we have here and the type of the American engine? Well, the great points in the American engine are that all the springs are equalised—the distribution of weight is thoroughly scientific. I do not consider the American engine would injure the permanent-way, as I think the English engine, with separate springs fixed in the usual manner, would do. Up to the time when I first saw an American locomotive, I was as strongly in favour of the English as other people. I saw an American locomotive first in Victoria, in 1877, and I concluded then that the American engineers knew as much, or more, than we did.

3058. Where is the centre of gravity in the American engine;—take the passenger express, for example; the three-wheeled couple—where is the centre of gravity there? I should say somewhere there between the coupled-wheels, slightly towards the driving-wheel [*pointing to a photograph*].

3059. Supposing you take it and compare it with the English engine, such a one as we saw at the works, on the American engines you say the wheels receive about the same load? They are equalised one with the

the other so that if, for example, the leading wheel should drop into a hole the load per wheel will remain the same.

3060. Supposing the centre of gravity be about the same in each case, then the loads in the driving-wheel of the American engine would be greater. Take the engines in these photographs. [Witness pointed out on the photograph what he believed to be the advantage in the American engine in equalising the weight of the wheels.] The centre of gravity would be practically the same in both cases? Yes.

3061. The effect of oscillation would be in the case I have pointed out to you in this photograph to make one of the wheels strike the rail? I do not think the oscillation you speak of is likely to take place.

3062. You mean that, even admitting that the English engine has on the third driving-wheel less weight than the American engine, that the blow-stroke by the American engine would not be as great? You have asked the difference between the English engine and the American engine, the blow would be greater in the English engine, due to oscillation you name, than it would be in the American engine.

3063. *Mr. Hoyle.*] Whilst you were acting, or were in power in the Department, certain orders, I believe, went to the Baldwin Company for the purchase of ten engines? Yes; the 304 class—"Mogul."

3064. When you sent that order did you send a specification? Yes, I did.

3065. Did you state in that specification that their best material should be used—whether iron or steel? I do not know.

3066. Did you specify that the axles should be of the best quality? So far as I remember, I specified that they should be made of "Otis" steel; that is the best known material in America—it corresponds with English steel of the best makers.

3067. Why did you make that condition? Because of my experience of the Consolidation engines, which have "Otis" steel axles. They were sent here in 1878 or 1879, and gave every satisfaction. There seems to be excellent material in the axles, and they are, I believe, in use now.

3068. Will you tell the Commission why you specified this particular kind of steel? Because it is the best material for axles.

3069. Was it because you considered that it was unsafe to have anything but the best material in the axles?

3070. *President.*] He says it was because it was the best stuff for axles. He does not say that he considered it unsafe to have any other material.

3071. *Witness.*] I would not like to say that iron axles would be unsafe, but I would immensely prefer steel to an iron axle in a locomotive.

3072. *President.*] If you wanted to get the very best thing you could get you would ask for steel axles? Yes.

3073. *Professor Warren.*] And the very best steel? Yes; "Otis" steel.

3074. You mean that an axle should require the very best material you can procure? Yes.

3075. Did you, in addition to that, specify any tests to be made? No; the engines were ordered in a hurry, and I had to sit up at night to write the specification, and my sketches were made in the margin of the specification. I did not specify any test, nor is it usual in a specification for locomotive axles to do so. I have seen tests specified for boiler plates and copper plates, and it is usual only to name one or two good manufacturers of axles, and that their material must be first-class.

3076. You did not send detailed drawings of your specifications? No; not for the first lot of ten engines; there was not time, but for the second ten I did, because there was ample time.

3077. How many drawings would be made? About eighty-four.

3078. So you sent practically about that number? Yes; as a matter of fact, these later engines were made in Scotland, but the Baldwin Company had the opportunity of tendering also.

3079. Had you an inspector in England? Yes; we had Sir John Fowler in England.

3080. But you had no inspector in America? No; I do not believe in an inspector.

3081. Why? Well, for the simple reason that an inspector such as are usually appointed in these cases, they would probably pay no attention to. An inspector is generally a young man who has just served his pupillage, and it is probably his first job, that is usually so. Sometimes a Company will appoint an inspector for certain reasons, and sometimes they point out a little thing and get it altered.

3082. *Mr. Brown.*] You consider that the Baldwin Engine Company was of such high reputation that it was not necessary to appoint an inspector? Yes; I would have trusted them, or any other similar firm.

3083. *Professor Warren.*] If you did not send working drawings, still less would it be necessary to send an inspector;—assuming that you had working drawings, then you would not appoint an inspector? No; I should always prefer dealing with a firm, and trusting it, rather than appointing an inspector, unless with regard to some special case; for example, any special departure in an engine that I particularly wanted carried out in a certain way, I should certainly send an inspector to see that my views were regarded, not to see if proper material were used altogether, or anything of that kind, but simply to see that my views were carried out. Those are the only conditions under which I should appoint an inspector.

3084. *Professor Warren.*] In that case, if you did think it necessary to appoint an inspector, would you not put in a clause also that the work was to be done to the satisfaction of the engineer, &c.? Yes.

3085. And a specification that had no such clause would be practically useless? Yes.

3086. *President.*] If it is not to be done to the satisfaction of the inspector, then I take it the inspector has no use? Yes; the late Mr. Meikle had a lot of engines made at Ballarat, in Victoria, and the Minister appointed an inspector, and the locomotive engineer respected that officer, and in consequence of what happened there was great trouble and an investigation, and the matter was attended with very serious results. I think that proves my case. I daresay Mr. Fehon remembers the occurrence. It showed that the inspector was of no use whatever—rather the opposite.

3087. The proper thing is to have working drawings and specifications? Yes; that is what I would have, or an inspector under special conditions to give an official certificate.

3088. What certificate? Your own certificate for official acceptance? If an engine comes here, and passes my supervision, then I will pass it. I prefer trusting to the firm to send me a good article, and if they do not do so, then I would send it back at their risk. If a man specifies for what he understands, well and good, but if there is a false impression as to what is wanted, then perhaps you may not get the article you want exactly. It would be more risky if you had no specification in that case. If you know what you want, and send drawings and specifications, I think you may trust to the material being good.

3089. *Mr. Hoyle.*] Were you in the service when the first ten locomotives were delivered? Yes, I was, but about a week after the first engine was tried I was suspended from duty.

3090.

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3090. After they arrived did you make any examination of them? As well as I could during the week I was in office.

3091. Did you consider it any part of the officer's duty to minutely examine the engine when it was being put together to see that the specifications had been carried out? Yes. And if I could not do it myself I would depute one of my best officers to do it, and if he saw anything objectionable he should of course call my attention to it, but I should do all I could myself.

3092. When these engines arrived did you see any of them? Yes; I saw one the first day the engines were about to be tried.

3093. You were present the first time the engine was being blown through? Yes, I looked at that one, but not very closely. It is true I have seen them since in the running shed but not recently.

3094. Relative to the Baldwin passenger engine, I wish you to tell us whether that engine, having a weight of 15 tons 9 cwt. on its driving-wheel, you consider, taking into consideration our permanent-way not the 80-lb. rails in the suburban line, but the ordinary iron and steel rail on our permanent-way generally, that engine is too heavy weighted on the driving-wheel? Yes; I certainly do; I think it a most serious question.

3095. And you consider 15 tons 9 cwt. is too heavy a weight on the driving-wheel of that engine? Yes, on that or any other engine. Under the circumstances I should think it much too heavy for a 71½-lb. rail.

3096. Have you any knowledge of the weights of the engines used in the service before these arrived. Is there any engine now running on our line more heavily weighted than the Baldwin passenger? Yes; there are twelve of the 351-class of engine, built by Beyer and Peacock. Six more were built in the Colony, they have 16 tons 7 cwt. 3 qrs. on the driving-axle, yet they are the smallest engine on the Suburban line.

3097. *Professor Warren.*] Is that the newly imported suburban engine or the old? The old; the first order was given about 1882, but it was cancelled, and they were afterwards built about 1885. If I may quote from a paper I have here, the weights of engines are as follows:—

BALDWIN, 10-WHEEL PASSENGER.										NEW, MANCHESTER 10-WHEEL PASSENGER.											
L.		R.		Total.		t c. q.				L.		R.		Total.		t c. q.					
3 9	3+3 10	0= 6 19 3	}	Bogie	.....	13	19	0		3 14	3+3 4	0= 6 18 3	}	Bogie	.....	14	18	1	
3 11	3+6 19	1= 6 19 1								3 19	0+3 10	2= 7 9 2								7 8	2+7 10	0=14 18 2	7 10	1+7 10	1=15 0 2	}	Coupled	...42	11	0
7 5	0+7 5	0=14 10 0	7 14	2+7 14	2=15 9 0	5 17	0+6 16	0=12 13 0													
7 9	1+7 9	1=14 18 2	}	Coupled	...44	17	2			57 9 1			57 9 1								
58 16 2										58 16 2											

3098. *Professor Warren.*] I think it will be better for us to get the weights accurately. Mr. Hoyle has said, the weight on the driving-wheel of the Baldwin passenger engine is 15 tons 9 cwt. but I take it there may be a difference in the weight. Some may weigh more; you cannot adjust it nicely. The locomotive you refer to is the 351 class of which I believe there are eighteen. Can you read to us the exact weights? The weight on the leading wheel is 7 tons 18 cwt. 1 qrs.; on the driving-wheel, 16 tons 7 cwt. 3 qrs.; on the trailing-wheel, 14 tons 15 cwt. 3 qrs., making a total weight, loaded, of 39 tons 1 cwt. 3 qrs. But this is not regarded as sufficient, I believe, because I learn that a cast-iron buffer beam has been put on one engine in front to make it heavier; the weight on the leading wheels is light, and that on the driving-wheel and trailing-wheel is very heavy, to keep the engine down in front a cast-iron plate has been put on, as stated, 9 in. x 4½ in. x 9 ft. about.

3099. *Professor Warren.*] I see these engines have 16 tons 7 cwt. 3 qrs. on the driving-wheel, which is in excess of the Baldwin engines?

3100. *Witness.*] These engines never go up-country; they never go beyond Parramatta and Liverpool.

3101. *Mr. Hoyle.*] Were there not other engines besides the particular lot you have referred to, with a weight greater than about 15 tons on their driving-wheel? No, that is the heaviest I know of. The next is the 158 class, and the next the Baldwin, the new Manchester engine, and the "Vulcan" engines.

3102. *Professor Warren.*] Had any of these tank engines you have referred to run over the western line? No, the first two types of engines I have referred to have their limit—Parramatta and Liverpool.

3103. Were there any running over the western line nearly as heavy? I think the Vulcans were very nearly the same—twelve engines delivered in 1887, to surpass mine.

3104. Did you design those? No, Mr. Scott, Sir John Fowler, and Mr. Burnett did, I believe.

3105. *Mr. Brown.*] Have you the records of the Vulcan engines? Yes.

3106. They are engines similar to the Baldwin engines and employed in similar work? Yes.

3107. We do not want you to give us the suburban engines; can you tell us the weights of the Vulcan engines. The "Vulcan" type of engines No. 373 to 384. The first bogie axle carries 8 tons 11 cwt. the second carries 8 tons 10 cwt.; the driving-wheel, 13 tons 17 cwt. 2 qrs.; the trailing-wheel, 14 tons 8 cwt. 2 qrs., making a total weight of 45 tons 7 cwt. This is a 4-wheeled couple with a double bogie in front. The 158 class of tank engine have double bogies also.

3108. *Professor Warren.*] Looking at the weights on the Vulcan surely you would not say that that engine would put as great a stress on the railway line as a Baldwin engine? There are 15 tons 9 cwt. on the driving-wheel of the Baldwin and 14 tons 8 cwt. 2 qrs. is the heaviest weight on the Vulcan wheels, therefore the Baldwin engine would be the worse of the two.

3109. So you think that would be heavier on the permanent-way than the Vulcan? Yes; the "concentrated load" would be.

3110. And the English engine has 16 tons 7 cwt. on one of its driving-wheels; you say that would also be heavy on the permanent-way? Yes; and I think the new engine imported is worse, so far as the weight and the stress; I mean the Manchester engine; it has separate springs. The weights are as follows:—First bogie axle carries 7 tons 9 cwt. 1 qrs.; second bogie axle carries 7 tons 9 cwt.; leading coupled axle carries 14 tons 19 cwt. 2 qrs.; driving-axle carries 14 tons 19 cwt. 2 qrs.; trailing-axle carries 12 tons 13 cwt.; total, 57 tons 0 cwt. 1 qr.

3111. *Professor Warren.*] Is there not a difference in the English and American principle, although there may be smaller weights on the trailing and driving-wheels in proportion to the load? The object is to get the weights equally if you can.

3112. Do not English engines try to get that equality? Yes; the Vulcan engine has a cast-iron foot-plate, which goes between the frames to load wheels equally.

3113. They have overloaded it? Yes; rather.

3114.

3114. *Mr. Brown.*] What engines were there in the service that, comparatively speaking, could compare with the Baldwin engine, with regard to the weight on the wheels? These Vulcan engines.

3115. That is the nearest approach? Yes.

3116. *Professor Warren.*] It is 14 tons 8 cwt. against 15 tons 9 cwt.?

3117. *Witness.*] I can read some extracts upon the subject, but I do not quite see what it has to do with the Baldwin engine.

3118. *Mr. Brown.*] It is interesting for us to know what engines are suitable for the permanent-ways in the Colony, for one of the things we have to inquire into is whether the Baldwin engines were fit for our permanent-way.

3119. Which engines do you think are most suitable for our permanent-way? The Mogul engines and tenders of 1885, and the corresponding ones which have lately come from Glasgow.

3120. *Professor Warren.*] Do you know class 158? Yes; I know that class. It is a suburban engine, I think; I have alluded to class 158, of which we have six.

3121. When were they imported into the service? They were imported in 1880 by Mr. R. H. Burnett.

3122. Do you know the weights on the wheels of those engines? The weights on the wheels are as follows:—On the four bogie wheels, 10 tons 0 cwt. 2 qr.; on the driving-wheel, 15 tons 1 cwt. 2 qr.; on the trailing-wheel, 14 tons 19 cwt. 1 qr. Total, 40 tons 1 cwt. 1 qr. In each case I am quoting in steam ready for a journey.

3123. So that these engines would be able to run on the permanent-way? Yes; we have been running them from 1880 to the present time. They go to Parramatta with the bogie wheels in front, but on the return journey they travel with the bogie behind, and that I think has a tendency to destroy our permanent-way. [*Here witness described, with the aid of a diagram, what he meant.*] If it is necessary to run bogie foremost in going to Parramatta, then it should be necessary to turn the engine at Parramatta, and send it foremost back to Sydney again.

3124. *Mr. Brown.*] I thought it was contrary to regulations, to run tender first? That is so, in the case of engines with tenders.

3125. *Professor Warren.*] What is the weight on the driving-wheels of your own engines, which were tested by Mr. Alison Smith and Mr. Roberts [*referring to diagram and a Parliamentary paper*]?—12 tons I take it to be? Yes; in the new Dub's engines, the weight is 46 tons distributed in the following way:—The weight on the bogie axle is 8 tons 10 cwt.; on the leading axle, 12 tons 10 cwt.; on the driving axle, 13 tons; on the trailing axle, 12 tons 10 cwt. Total, 46 tons 10 cwt. My specification ordered steel fire-boxes and steel tubes, but my successor altered it to copper and brass respectively, which made the engines heavier than I intended.

3126. Then really American engines, you say, were built by an English firm? Yes.

3127. *Mr. Hoyle.*] I want to ask you, as a locomotive engineer, whether when you are designing an engine you are guided by the strength of the road or not? That is the fundamental basis of the whole thing. The weight of the rail in pounds per yard and the cross-section settles the whole thing. The late Commissioner always urged me to keep down the weight of the rolling-stock, and that it should be constructed for 72-lb. rails, which was the standard when I came to this country, and is has never been altered.

3128. The answer to the question that is now being put to you is very important;—I want to know from you, do you consider it dangerous to run a Baldwin engine with a weight as described on the driving-wheel over a 75-lb. iron rail? It depends on the size and distance apart of the sleepers, of course. If the sleepers are 3 ft. apart, as they are said to be on the Tarana section (I take the information from some of the reports), then I consider it the height of madness to run such an engine on such a road, in such a condition, I would not like to do it unless ordered by my superior officer, and then I would not take the responsibility. I do not say it is dangerous, but some day it might be awkward. I would rather confine myself to what was discreet and wise.

3129. *Professor Warren.*] You would not do it if you were the engineer in charge? No.

3130. *Mr. Hoyle.*] I am going to put a question to you about the rail, and I may say that I personally have had great experience of rails, of old rails and new ones, iron and steel; I have been constantly working and breaking them for ten years, so that I have special experience;—you know, of course, as an engineer, that by continual running over iron rails the rail becomes crystallised at the part over which the train passes? Yes.

3131. If an iron rail, having been run on, becomes crystallised on one side and some places bulged, do you consider it would be safe, then, to turn that rail over upside down and run engines of the weight of the Baldwin engines over it? Certainly not, if it is a bulged rail. If there was the slightest appearance of a bulge I would put it aside.

3132. If a rail had become crystallised by being run over, by turning it over and crystallising the other side it would be as safe as a rail which has been run over on the one side only? No; certainly not.

3133. *Mr. Fehon.*] There has been no evidence that this rail was bulged. I mention this because these statements made by Mr. Hoyle, taken in connection with the Tarana accident, if they went forth through the Press would alarm the public, who might think that the road was in this bad condition.

3134. *President.*] There has been no evidence of this kind, but perhaps Mr. Hoyle is asking these questions in anticipation of calling someone.

3135. *Mr. Brown.*] I think Mr. Hoyle is asking the witness his opinion as an expert.

3136. *President.*] Suppose you had a double-headed rail, one side of which was crystallised and there was a bulge on it, would it be safe to run upon it; I think the question may be put in that way; I cannot prevent Mr. Hoyle asking it in that form; its only value would be if afterwards he proved that some of the rails were in that condition.

3137. *Mr. Fehon.*] The evidence is given, and the public may think that questions and answers are based upon actual observation with regard to these rails, or any particular rail.

3138. *President.*] If this question is asked with regard to any rail, all I can say is that the evidence about this rail has not been given. I cannot prevent Mr. Hoyle putting a hypothetical question, which is all this question is at present. There is no evidence whatever that any such thing happened as that which he asks about; but, since these questions are put in this hypothetical way, I cannot very well object to them.

3139. *Mr. Fehon.*] In calling attention to the question I did what I considered was necessary.

3140. *President.*] There is no evidence whatever that anything put in this hypothetical way has been done.

3141.

Mr.
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3141. *Mr. Hoyle.*] I am simply asking an expert for a particular opinion. I may say that I have examined the road very carefully myself, and that I have seen places where the rails have been turned over between the Tarana station and the place where the accident took place. I have seen them turned over, and some of them I noticed bulged between the chairs.

3142. *Mr. Brown.*] But is not that why you get double-headed rails—in order that you may turn them over; but if it becomes defective on one side is it safe to turn it on the other side, and run this great weight over it?

3143. *Mr. Fehon.*] We have inspectors, gangers—men of experience and trust—who have been engaged on the lines all their lives keeping them in repair, and these men are responsible for keeping the roads in order, and we suppose that they do so, and are satisfied that the road is kept in order, notwithstanding any amateur expressions of opinion with regard to this matter.

3144. *Professor Warren.*] I understand, Mr. Hoyle, that you said that if you turned over a rail it is not as good as it was before?

3145. *Mr. Brown.*] The reason for getting double-headed rails is that they may be turned over, but I believe they are now being done away with on account of the expenditure and the fact that part of the rail is embedded in the chair. It is considered better to use the ordinary T rail?

3146. *Professor Warren.*] When a rail has been subjected to a certain load, which is as much as it can carry safely, some process appears to go on within it which causes it to be much weaker than before, and it becomes quite what is called “fatigued,” that is supposed to be some sign of weakness, and if you turn the rail over you increase the “fatigue,” and it is proved by twelve years of experiments that nothing will cause “fatigue” more than the reversion of stress. I take it that that is the reason that double-headed rails are going out of use.

3147. *Mr. Brown.*] It has been determined recently to a nicety what the life of a rail is?

3148. *Mr. Fehon.*] It varies with the weight of the rail, but the life of a rail is now pretty well ascertained. It is the amount of the traffic travelling over the road that causes the wear and tear, and through it the rail would become lighter and lighter, and when the weight comes down to a certain thing that rail is discarded, and considered to be no longer suitable for the purposes of the road.

3149. *Mr. Brown.*] On the suburban roads they have to be renewed frequently, whereas on the up-country roads where the traffic is not so great they last longer?

3150. *Mr. Fehon.*] Yes.

3151. *Mr. Hoyle.*] I might point out that a double-headed rail sometimes wears a hole in the chair, and I believe that has had something to do with the failure of double-headed rails.

3152. *Mr. Brown.*] And I understand that the weight of the stuff that is put over the rail has something to do with it?

3153. *Mr. Hoyle.*] And the weight of the rolling-stock?

3154. *Witness.*] Yes; upon that depends the security of the roads to a great extent, and also that of the cross-girders on the bridges. They also would be affected by the concentrated weight passing over them. The axle that is loaded the heaviest governs the whole thing.

3155. *President.*] You mean to say that, however good a thing may be that it is not strong enough if the weakest part cannot bear the greatest strain. It is like the weakest link in a chain—the strongest part is the weakest link?

3156. *Mr. Hoyle.*] With the chairs 3 feet apart, do you consider that 15 tons 9 cwt. is too great a weight to travel over these rails? Yes, I do; 6 tons is the limit.

3157. *Professor Warren.*] That is 12 tons and a pair of drivers? Yes.

3158. *Mr. Fehon.*] Are any of the sleepers 3 feet apart in the length of the road?

3159. *Mr. Hoyle.*] Yes; I have measured them, and have seen them 3 feet 2 inches apart.

3160. *Mr. Fehon.*] Were they 3 feet apart, or 3 feet apart from the centre, because if you mean from the centre that they are 3 feet apart that is really only 2 feet apart?

3161. *Mr. Hoyle.*] The chair is on the sleeper, but the chair is only 2½ inches in width, so that the weight is on the chair and on the sleeper as well.

3162. *Witness.*] The report of the Engineer-in-Chief of 26th May, 1891, says—with regard to the permanent-way on the Northern line—this is Mr. Deane's report.

3163. “From Murrurundi to Tamworth the rails are of *iron*, single-headed and fish-jointed throughout, and weigh 70 lb. per lineal yard. They are in lengths of 21 feet and 18 feet, and are secured to the sleepers by spikes and screws alternately.

3164. “From Tamworth to the Queensland border the rails are of *steel*, single-headed and fish-jointed throughout, and weigh 71½ lb. per lineal yard. They are in lengths of 24 feet, 21 feet, and 18 feet, and are screwed to the sleepers in a similar manner.”

3165. “Sleepers—From Murrurundi to Tamworth these sleepers are of iron-bark, stringy-bark, tallow-wood, and other Colonial hard-woods, 8 feet 9 inches long by 4½ inches, and rectangular in form. For 21-foot rails they are placed 3 feet 1 inch apart from centre to centre, 2 feet 6 inches at the joints; and for 18-foot rails, 3 feet 1 inch and 2 feet 7 inches at the joints.

3166. “From Tamworth to Tenterfield the sleepers are of the same description, and for 24-foot rails are placed 2 feet 8½ inches apart from centre to centre, and 2 feet 3 inches at the joints; for 21-foot rails, 2 feet 8½ inches, and 2 feet 3 inches at the joints; and for 18-foot rails, 2 feet 7½ inches, and 2 feet 3 inches at the joints.” The sleepers are 3 feet 1 inch apart.

3167. *Mr. Fehon.*] The sleepers are 2 feet 4 inches apart.

3168. *President (to Witness).*] Where are you getting this evidence from?

3169. *Professor Warren.*] From Mr. Deane's report.

3170. *President.*] Why should not Mr. Deane be recalled?

3171. *Professor Warren.*] Supposing the sleepers are 3 feet 1 inch apart measured from the centre, and the rails weigh 70 lb. per yard, what is the maximum weight you would allow in that case? Six tons. I take the weight of the rail in lbs. per yard; 6 tons per wheel is the weight for a 71-lb. steel rail.

3172. If it were a 75-lb. rail, what would you allow? About 6½ to 7 tons, twelve times the weight in tons on one wheel gives the weight of the rail in lb. per yard. You will find it in Molesworth. I wish my evidence to be consistent with such an authority, and also my practice and experience tells me they are quite right.

3173. *Mr. Hoyle.*] The T rail would have a flat bearing surface on the sleeper face, therefore that would be a greater security to the rail than if it were placed in chairs? Yes.

3174.

3174. Do you consider that a T rail, with its surface on the sleeper, unsafe to run with an engine with a weight of the Baldwin, over that road, and with an iron rail? I would not say unsafe, but it is highly injudicious and improper.

3175. I have asked already for a copy of the dimensions of these engines;—do I understand that the wheel base of these engines is 12 feet 6 inches—the rigid wheel base?

3176. *Professor Warren.*] I believe that the dimensions that you now refer to are at the Government Printer's. Here is a specification which I think shows it; I think it is 13 feet 6 inches.

3177. *Mr. Midelton.*] Twelve feet 6 inches. I think that is it.

3178. *Professor Warren.*] However, the dimensions are at the Government Printer's, and we have not got them back yet.

3179. *Mr. Hoyle.*] I think it has been stated that the rigid wheel-base is 12 feet 6 inches.

3180. *Professor Warren.*] Yes; I think it said rigid wheel base 12 feet 6 inches.

3181. *Mr. Hoyle.*] Well, taking into consideration these engines and the weight on the driving wheel, do you think they would have any tendency with the rigid wheel base of 12 feet 6 inches to strike hard at curves, and thus spread the road? I glanced at the bogie when the engines were being put together, and the swinging links hung vertically in it, and I would like to ascertain accurately by further examination first before I answer that question. If the links are in a vertical position I think the engines would swing very much at the curve at high speeds.

3182. I think you know exactly the weights on the bogie;—perhaps it would be useless for me to ask you any questions relative to it until you have seen them? I think it would be unfair to do so until I have seen it, and especially on that point, my argument is that the links are hung vertically. I have found by experience with the Baldwin and other engines that is a mistake, and I remember having had some correspondence with them regarding it. The links, as set in the original Consolidation engines are in the best possible position, but if the links in the new engines are set vertically, I do not agree with it.

3183. *Mr. Brown.*] Why should you not see these engines? I do not know.

3184. *Mr. Fehon.*] He can see the engines, but we have a strong objection to gentlemen in such a position as Mr. Midelton is, going about the works and talking to men.

3185. *Mr. Midelton.*] I hope I know my position well enough not to do what Mr. Fehon suggests.

3186. *Mr. Brown.*] He says he cannot give an answer unless he sees the engines. I do not think you can have any objection to his doing that?

3187. *Mr. Fehon.*] No, we have no objection; but one of our officers must accompany him.

3188. *Mr. Brown* (to Mr. Hoyle).] I understand you want Mr. Midelton to see the engine. Then I might make a request to him to examine the engine in all its parts.

3189. *Professor Warren.*] You mean as they are shown here (*showing a diagram to witness*);—the front end of the engine would grind severely against the rail, you thing, if the link is vertical? Yes.

3190. *Mr. Brown.*] I wish you would examine the apparent flaws in the wheels and tell us whether you consider them serious flaws.

3191. *President.*] And let him sound the wheels. When you go to examine the engines look at it not only with regard to the length, but also have a look all round it and give us the benefit of your judgment about it.

3192. *Mr. Hoyle.*] When you drew certain specifications for these engines, was there any objection raised by the Baldwin Company to work to them? It was not an objection altogether. They had a little fear that a domeless boiler would be a mistake.

3193. With reference to the domes? All my engines are domeless. I contend that an engine supplies drier steam without the dome than with it. I have very fine testimonials from the Baldwin Company saying that the suggestions I made were very successful. There were a number of alterations which were made at my request, and which have been followed out since with success. Some are embodied in the great engines for the St. Clair tunnel.

3194. *Mr. Hoyle.*] Can you tell me if you think that the piston-head in these engines was too heavy? I could not say that. I should like to see them and then I could give an opinion on the subject.

3195. *Professor Warren.*] Do you consider that the piston-rods should have been continued through the stuffing-box so as to support it? I should like to see the engine first before I gave an answer.

3196. *Mr. Fehon.*] Mr. Midelton, it must be understood, will not be at liberty to order the engine to be pulled to pieces in order to see what is inside it.

3197. *Professor Warren.*] Well, we would like to find out whether those cracks we saw in the wheels at Eveleigh were in the material or only on the surface.

3198. *President.*] Mr. Midelton will not want to break the engine open. It will not be necessary to break anything to do what we desire.

3199. *Mr. Fehon.*] We will not allow Mr. Midelton to go alone. He must be accompanied with one of our officers.

3200. *Mr. Brown.*] I want Mr. Midelton to make a critical examination. I do not want him to pull an engine to pieces, but to examine the engine as a critical person, and to come here and say all he can say about it; and I hope you will give him every facility for doing that.

3201. *Mr. Fehon.*] Yes; we shall.

3202. *Mr. Hoyle.*] It has already been given in evidence, that a Baldwin passenger engine has pulled 167 tons up the Lapstone bank, 1 in 30, would you consider it safe for the draw-gear on the goods stock to haul such a load? No; highly dangerous. If the design of draw-gear I have inspected on some new Stopper waggons at Newtown Station is the standard, I should say it would be culpable negligence.

3203. *President.*] We are talking of course about the Baldwin engines.

3204. *Mr. Hoyle.*] You think that the draw-gear might break—that the train might perhaps run back, and you would have a similar accident to that which occurred at Bathurst? Perhaps.

3205. *Professor Warren.*] You did not specify in your specifications what the draw-gear should be? No. I sent drawings to Dubs & Co.

3206. *Mr. Hoyle.*] Was it safe to haul 167 tons up a grade of 1 in 30, with the draw-gear in use? I say most emphatically it would be highly blameworthy to do so, with the Baldwin engines or any other engines, to take such a load up that grade, with draw-gear such as I saw at Newtown Station on the Stopper-waggon.

3207. *President.*] I do not know what *that* draw-gear is, do you know the strongest draw-gear they have? Yes.

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- Mr. T. Midelton. 3208. Well, supposing they use that, would there be any danger then? I consider there would, and if you took 160 tons up the grade you would have to sand the rails pretty well, there would not be sufficient adhesion unless the rails were sanded.
- 3 May, 1892. 3209. *Professor Warren.*] Do you think a Baldwin engine could take 175 tons up a grade of 1 in 40 at the rate of 22 miles an hour? I question it very much—I would like to see it done. It certainly would be necessary to sand the rails copiously, and I do not think it correct to use sand when hauling; if an engine is properly proportioned it can do the work without sand, on a dry rail, such as we have.
3210. Do you consider that on an ordinary day it would do that? I do not.
3211. *Mr. Brown.*] I do not think we have got anything to do with the draw-gear of the waggons, but only with that of the Baldwin engines.
3212. *President.*] I only ask the question on account of his saying that he had seen something at Newtown; I presume the Commissioners put strong enough draw-gear on their rolling stock?
3213. *Witness.*] These wagons are available and go to Lithgow to be filled with coal, consequently are subjected to all sorts of stress.
3214. *President.*] All that we are inquiring into is whether the Baldwin engines are defective or not. The draw-gear might be a matter that it would be well for us to report upon, but we are not called upon to do so. We must assume that they have fastened their trucks with proper gear, we have not got to try that matter.
3215. *Mr. Hoyle.*] Well, I may state that it is clearly within my intention that this matter should be inquired into. I have said in my third charge that the safety of the draw-gear would be in danger if the Baldwin Consolidation engine drew the loads which it was said by the railway authorities they were intended to draw. I had in my mind not only the draw-gear of the Baldwin engines, *but of other rolling stock*, so that if the draw-gear of the first and second truck between the engine and the load should break, it would be caused by too great a load having been taken.
3216. *Mr. Brown.*] I thought that the evidence went to show that the draw-gear of these engines had been replaced by new draw-gear.
3217. *President.*] I am sorry if I have mislead you, Mr. Hoyle, I can only comply with the charges contained in our Commission, namely: that the Baldwin engines are defective, are unsuitable to the permanent-way, and do not do the work they were expected to do. It might be unsafe, to have so many waggons attached to these engines, but we have not anything to do with that.
3218. *Mr. Hoyle.*] It endangers the lives and property of people.
3219. *President.*] Well, I cannot go generally into the matter, I can only go by the terms of the Commission. I cannot go beyond the draw-gear attached to these engines. I think it is what my colleagues have also thought, that we had only to do with the draw-gear attached to the engines, not with that attached to the waggons.
3220. *Professor Warren.*] That is clearly in my mind; I thought that Mr. Hoyle referred to the draw-gear on the engine itself.
3221. *Mr. Brown.*] We are bound to presume that the draw-gear generally is sufficiently strong for its work, and if it is not, well, the Railway Commissioners will have to pay for it.
3222. *Mr. Hoyle.*] When I made a charge against the engines, speaking in Parliament, I said that it was the draw-gear on the goods vehicles more than anything else that I feared when these engines were being used, as the draw-hook of the engine itself, there is no doubt that it is very strong, but I certainly had the draw-gear on the goods vehicles in view at the time I made these charges. It is a danger, and it was the great load that these engines had to draw that directed my attention to the draw-gear.
3223. *President.*] If you could show that this was a tremendous load, and that there was ground for this supposition that perhaps might be evidence of neglect—but I cannot go outside the terms of the Commission—what we have to try is whether these engines are defective or unsuitable to the permanent way, or are not doing the work they were expected to do. If the Commissioners put a load behind the Baldwin engines which would inherently be too much, that would be a mal-administration outside the terms of this Commission. This ruling must be looked upon as final.
3224. *Mr. Fehon.*] May I read from the charges?
3225. *President.*] I do not think it necessary—I have decided against Mr. Hoyle.
3226. *Mr. Fehon.*] I was going to point out a most apparent inconsistency.
3227. *President.*] I do not think it is necessary; I am not responsible for the Commission, and I did not know what the terms of it were until I unfortunately got it. The terms of the Commission are what I have intimated, and we must keep within them. Otherwise we might go into an irregular, wide, and expansive enquiry, and anything whatever might be raked up. I did not know anything about the terms of this Commission until I got it at Hay—very much to my sorrow.
3228. *Mr. Hoyle.*] It has been said here in evidence that there would be little or no danger, or there might be no danger, in a bogie-axle breaking whilst the train was going at a speed of from 30 to 35 miles an hour;—do you think, as an engineer, from your experience on English and American engines, that it is not a dangerous thing for a bogie-axle to break? Well, of all railway accidents conceivable, the most to be dreaded is a broken axle, a broken rail, or tire—a bogie-axle above all, because it is the leading axle to guide the engine, I would consider nothing worse than a breaking of a leading or bogie-axle. The two greatest accidents in England, I believe, were in one case a leading axle breaking, and in the other a crank-axle breaking.
3229. *Professor Warren.*] Do you consider it a very serious thing? Yes, I do indeed. You cannot guard too much against wheels, axles, tires, and draw-gear breaking.
3230. Is that the reason why you stated that axles should have the very best of material in them? Yes; wheels, tires, axles, and draw-gear, should have good material in them. They cannot be examined too often, or looked after too much.
3231. *Mr. Hoyle.*] Could you explain anything you know about axle accidents? There have been a good many accidents of that kind in England. Speed has been very high, and sometimes they break without warning; sometimes a little crack will appear, and it may not be detected, and then an accident may be caused.
3232. *President.*] You need not labour to show us, Mr. Midelton, that it is a serious thing for an axle to break—for my own part I think it is a most serious thing.
3233. *Professor Warren.*] So do I.
3234. *Mr. Hoyle.*] It has been sworn here that it is not a dangerous thing.
- 3235.

3235. *President.*] Well, people may come and swear that to me, but I do not agree with them, that is all, I use my common sense.

3236. *Mr. Hoyle.*] Can you state any particular case where an accident occurred in England or America, through a broken axle? I think I remember the Shipton accident, on the Great Western line, in 1875; there were about forty-five killed, and as many more injured. I forget whether that was an axle or a tire, perhaps Professor Warren will remember?

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3237. *Professor Warren.*] Yes, I think it was a tire.

3238. *Mr. Hoyle.*] Do you remember any other? The Pemstone accident, on the Manchester and Sheffield railway, occurred through a broken crank-axle. A locomotive superintendent was killed in that accident. There was not a more careful man in England than he.

3239. *Professor Warren.*] Do you know of any accident occurring through the breaking of the leading axle wheel? Yes, there was one on the Great Western line; if you look through the railway papers you will find that a good many accidents have occurred through that cause. We have had a good many cases of our own. For example, I think at Narrandera, I think, there was an accident caused through a broken axle.

3240. And Petersham? Yes, on the Petersham viaduct, some time ago. They do not always cause loss of life; sometimes they do. I always give great attention, in my Department, to the condition of the wheels and axles, and draw gear.

3241. *Mr. Fehon.*] The accident was caused through a truck axle at Petersham, and that has no reference whatever to the engines. (Witness) I was asked about axles generally, and the breaking of an axle is just as serious, no matter where it may be, or an engine or car.

3242. *Professor Warren.*] But if on the leading wheel it is worse than all? Yes, it may be worse than all, seeing that it is the leading wheel of the train, and governs the whole thing.

3243. It is the pilot-wheel? Yes.

3244. *Mr. Hoyle.*] These tires are shrunk on in the ordinary way, and held with a set screw? Which tires?

3245. I am referring to the tires on the Baldwin engines; I think they are fastened in this way, are they not? Yes, I think they are.

3246. Here is a template of a tire as fastened to a wheel. That you claim as yours, and you say that it has been the standard? Yes, that is mine, and it has been the standard since 1883.

3247. I want to know whether you consider that a perfectly safe fastener? It is the best that I know of.

3248. That one? The one nearest to me.

3249. Yes, this one? The other is one that Sir Henry Tyler, the late Chief Inspector of the Board of Trade, condemned as a barbarous system. Here is the rim of the wheel. This is the section of the tire when it is put on the wheel. It is heated and put on to the wheel like that, and it shrinks as it cools, and gets quite tight on the rim of the wheel. If you do no more than that to secure it there is nothing but the shrinkage of the tire that holds the tire to the wheel, and you can readily see that if it gets loose it will necessarily fly off. A hole is drilled into the tire, and this screw is put into it. That is done as a safeguard, to prevent the tire flying off if it gets slack, but as a matter of fact it will come off if the screw breaks. That is how the tires on the Baldwin engines are fastened. Now, with regard to the way in which I maintain that the tires should be secured. Here is the rim of the wheel again. That is a kind of dovetail. It hooks into the tire there. This is a separate ring that goes right round the wheel and hooks into that section of the rim and round the tire.

3250. Is that Mansell's fastening? It is a modification that I brought about from Mansell's. The other system allows the tire to turn round on a wheel if it works loose, but this system will not allow it to go round the wheel. This rivet being through the wheel and through the tire prevents the tire turning on the wheel in case it gets slack. It also prevents the tire flying off the wheel, even though it were to break in a dozen pieces. Another advantage is, the tires can be used longer.

3251. *Mr. Brown.*] Which is the barbarous one? This [*pointing to one of the models before him*] is the barbarous one; I am saying Sir Henry Tyler, the late Chief Inspector of the Board of Trade, called that a barbarous one, and I agree with him. It is not merely I who says so.

3252. And the other system is the one by which the tires are fastened on to your engines, whilst this, which has been described as being the "barbarous" system, is the way in which the tires are fastened on to the wheels of the Baldwin engines? The former is the way in which the tires are fastened to the wheels of my engines, but the other is the way in which the tires are fastened on all the wheels of all the other engines in this Colony.

3253. *Professor Warren.*] The system that you have adopted in regard to your own engine is Mansell's, is it not? It is a modification of Mansell's, no doubt, but it is really my own, and I could have obtained a patent for it years ago if I had liked, I dare say.

3254. *President.*] But I want you to tell us about the Baldwin engines;—how are the tires fastened on to the wheels of the Baldwin engines? Well, all the engines in the Department, excepting the ten engines that I obtained from Dubs and Co. from my own designs, are fastened in the manner that Captain Tyler 20 years ago described as barbarous.

3255. *Mr. Hoyle.*] Whilst you were in the Department was that modification of the Mansell fastening adopted as a standard? Yes; it was. Ever after 1882 all carriage and waggon wheels were made on that principle whilst I was in authority. The engine wheels have not been made on that pattern since, but the carriage and waggon wheels have. Previous to 1882 we had some wheels under "Ashbury" carriages fastened with Mansell's fasteners, but they were taken off, and I think are lying at Eveleigh workshops now. They were, however, some little time ago.

3256. *President.*] Do you say that the tires that are not put on by that particular method are defective? I do, most emphatically. I say that the evidence before the Department after my ten engines were ordered, with a fastening that will not allow a broken tire to come off even if it breaks, you would conclude that the Commissioners would have fitted later engines in that way, and I am very much surprised that it has not been done.

3257. *Mr. Brown.*] Then, inasmuch as the others are not fastened in that way, you say that they are defective? I do.

3258. And all the Baldwin engines being fastened like the rest of them, you say they are defective also in that respect? Yes; I may say that the first ten engines from the Baldwin works were designed like this, because I had no drawings and specifications at the time, but we took care to keep them off the Melbourne express trains.

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3259. *Mr. Hoyle.*] Have you had any experience, or had you any experience whilst you were in the service, of tires coming loose? Yes I had, and breaking too. There is an abundance of papers in the Department on that subject. I remember distinctly that, ten years ago, in 1882, the subject was taken up by the Department and thoroughly discussed.
3260. *Mr. Fehon.*] I would like a member of the Commission to ask if this evidence refers to engines or to waggons? It refers to engines, waggons, carriages, and every class of rolling stock we have in the service.
3261. *President.*] Then according to you, not only are the Baldwin engines defective, but every vehicle in the service, excepting the ten engines that you imported from your own designs, is defective also? No; not every vehicle—every engine. On the contrary, every tire on waggons and carriages has been fitted with the approved form of fastening, but the engine's tires have not, and therefore, what I say is, that all the engines except my ten are defective in that respect.
3262. Then according to you, the Baldwin and all other engines in the Colony, except your ten, have not got the tires properly fastened on? According to the experience of Captain Tyler, and my own and others, I consider they have not; and to prove that, the Americans are adopting the fastenings that I have just been describing as the better one on their engines. I can show you drawings of a tire fastening used where, I believe, Mr. Rhodes' brother is the chief mechanical engineer, on which road, I think, they are adopting the Mansell fasteners or a modification of it.
3263. *Mr. Hoyle.*] Do you know anything about the Baltimore and Ohio Company's engines? Well, I have read about them a good deal.
3264. Do you know whether the engines of which this last twelve are a copy, to a certain extent modified, are running on a 60-lb., 65-lb., or 70-lb. rail? I can only say that I have read——
3265. *President.*] How can he say what the rails are if he has only read statements regarding them in a book or paper. You can read the extract from the paper to us, Mr. Hoyle, if you like, and it will be just as valuable as anything that Mr. Midelton can say, unless he has actually seen the rails himself. A man can only speak in evidence of what he knows and not of what he merely reads. Of course you can get his experience if that is what you want. You can ask him whether such and such things are recognised as the proper things to be done, but you cannot ask him to retail statements that he has got from print.
3266. *Witness.*] It has been stated here in evidence before the Commission that the rails on the Baltimore and Ohio Railroad weigh 67 lb. to the yard, and I can show you a drawing of an 85 lb. steel rail on the same road—their standard——
3267. *President.*] If such a statement has been made, all I can say is that I did not notice it at the time, and do not remember it now. If I notice it when I come to read over the evidence afterwards it will then be my duty to tell the other members of the Commission that it is not evidence in any way whatever, and that they must dismiss it from their minds.
3268. *To Mr. Hoyle.*] You could get the effect of Mr. Midelton's answer in this way if you like. You can say to him what rail is safe for an engine of a certain weight to run upon. He may have obtained his information by reading even in that case, but he is asked his opinion, and gives you the result of his reading as his own opinion, and by his opinion he is bound, but we cannot allow him to state what the weight of these rails is unless he has seen them himself.
3269. *Witness.*] I believe the Baltimore and Ohio engines are running on 85 lb. rails, but I may say that I have heard that some of them run on 67-lb. rails.
3270. *President.*] That is really worse than what I have just been complaining about. We cannot possibly admit these statements.
3271. *Witness.*] Well, it is my business to take an interest in these things, and I consequently read a great deal about them.
3272. *President.*] Exactly, we know that it is your business to take an interest in these matters, and of course you will read a great deal about them, but it is just as if a doctor were in the witness box. He may say that so and so are symptoms of a certain disease, but he cannot go on and say I have read such and such a thing, nor can you state in evidence what you have just been doing. You can say that it is not safe to run a Baldwin engine with such and such a weight on the leading wheels, or with such and such weighting on the driving wheels over a 71-lb. steel rail or a 75-lb. iron rail, but you cannot say that certain rails are a certain weight merely because you have read that they are. In the former case you may be giving the result of your reading, but it is your opinion about it after all.
3273. *Mr. Hoyle.*] I have never seen England, but I know it exists.
3274. *President.*] It may be so, Mr. Hoyle, but I am only talking about what is evidence here. We may all hear about a murder in England, we may read about it in the paper, we may have no doubt whatever that the murder has taken place, but if you have to prove it that is quite another matter.
3275. *Mr. Hoyle (to witness).*] We were speaking about the tire of wheels just now. I want to ask you whether there is greater pressure upon a wheel after the tire has turned down to its utmost limit, and whether that wheel is as safe as when the tire is new. I am speaking of a tire fastened in the way in which the tires of the wheels on the Baldwin engines are fastened? When a tire wears thin of course it is weaker, when you get low enough you come to the end of this bolt unless it is put on one side, and near the tire flange. That cannot happen in the case of my tire, my rivet is horizontal; this stud is vertical.
3276. What I want to know is whether the wheel would be safer with a new tire than it would be with a tire turned down to its utmost limit, fastened as these Baldwin tires are fastened? Certainly it would be safer with a new tire than with a tire half worn.
3277. I am asking you that because we are going to call you again after you have examined the engines, and you will have to answer some questions about the wheels then. It has been stated in evidence before the Commission that the reason why some of the bogey axles broke, was in consequence of heating, and that the heating was caused through grit working out of bad parts of the iron. I wish to ask you whether you consider that heating would be caused in that way? If heating was caused in that way, there must have been laminations in the iron before the axles were used in the first instance. I do not think the axles would give off dirt from the interior of the iron unless there was some open fracture in the iron itself through which the dirt could work out.
3278. *Professor Warren.*] And if that were so, it would demonstrate that the axles were badly made would it not? Yes; badly forged I should think.

3279. Exceptionally badly? Yes; when I was in the Department, if ever I saw an axle with the slightest crack in it I made a practice of putting it in the testing machine at once.

3280. *Mr. Hoyle.*] And the lamination, which you say must have been noticeable in the first instance if grit was going to work out of the iron, might have been discovered as soon as the axle-box was taken off? If a full examination had been made it might have been discovered, and should have been properly recorded at the time.

3281. *Professor Warren.*] So that if it has been stated in evidence that the heating of the axles was caused from dirt working out of the iron itself, you would say that the flaw could have been seen before the axle was used? Yes; although, as a matter of fact, it might possibly have been developed afterwards. What I mean is this. You might examine an axle before it is used and see no sign of lamination. That axle might be worked for a while, and laminations appear; and those laminations, of course, you could not see without taking the axle-box off to look for them. However, I think marks of had forging would have been observable in the first instance before the axle had been used at all, and I should be extremely surprised to hear that the cracks had appeared afterwards.

3282. *Mr. Brown.*] You think that any fracture could have been detected before the engines had been put to any use? Yes; I think it might have been detected if there was a scale working out of the iron.

3283. *President.*] You mean to say that dirt could not work out of the axle without the place from which it was working out being discoverable? Yes.

3284. *Mr. Hoyle.*] We have evidence to show that some of these engines were lifted a number of times; and you think that if there was any slag working out of the iron it could have been discovered in the course of one of these examinations? I should have hoped that if anything was found to be working out of any of the axles any officer under me would have taken the axle off and subjected it to a careful examination before he allowed it to go out again.

3285. *Professor Warren.*] I want you to answer Mr. Hoyle's question.

3286. *Mr. Hoyle.*] We have had evidence to show that one of these engines was lifted a number of times. I want to know now whether if slag was working out of any part of the axle it could have been discovered when the engine was lifted, if the axles had been examined upon these occasions? Yes; there would have been evidence when the axle heated that there was something wrong, and if slag was in the centre of the axle when the engine was lifted there would have been evidence of its coming out. For instance, if the lamination had not been detected when the axle was new, and in the meantime heating had developed, then I should certainly have looked for the crack that I had failed in the first place to find. If I failed a second time to find them I should perhaps decide to turn it down afresh; it would be a matter to be determined purely by good judgment, careful examination, and experience.

3287. Well then if no laminations—no cracks were discovered—and the journal was perfectly clean, would there not be some other cause for the axle running hot? Well, it might be over-loaded. If an axle is overloaded you expect it to run hot whether that one was overloaded or not I cannot say. If it was badly lubricated it would have been liable to run hot also. Steel axles will run hot if they are overloaded, or if dirt gets into the box, or if there is neglect in oiling or anything of that kind, just the same as any other kind of axles.

3288. *Professor Warren.*] If the area of the brasses in which the axle revolves was insufficient, that would make it run hot, would it not? What do you mean by insufficient?—give me as an example an axle of any diameter, of 5 inches say.

3289. Yes, I want to know if the pressure on this brass is excessive—if it is more than you consider the pressure on such brass should be, would not that be the cause of its running hot? Oh, yes, undue pressure would make it run hot.

3290. What pressure do you allow? 3 tons for a 5-inch axle, and I give one quarter of the circumference for bearings. A 5-inch axle ought to carry 4 tons with safety, with a 3·0 wheel.

3291. *Mr. Hoyle.*] Would the manner in which the bogey is hung have anything to do with the axles running hot? Well it would tend that way on a curve. If the engine flies away at a tangent, which it would do, the weight would be greater on one side than on the other and the bosses would come in contact with the axle-boxes, in which case the friction must be greater on one side than upon the other, but that ought not to cause trouble, because the engines are made to run on curves of course.

3292. *Mr. Fehon.*] It has been admitted that the axles did run hot, and that they have been removed and replaced with steel ones.

3293. *President.*] Yes; the axles that came here in the first instance were very bad axles, there is no doubt about that.

3294. *Witness.*] I should like to see these axles, if for scientific purposes only.

3295. *President.*] I do not know that it is material, because it is admitted on all hands that they did run hot. Whatever was the cause of it, whether it was because foreign matter worked out of the axles, or whatever the cause was, it is admitted that they were bad axles. It might be very interesting and instructive to you from a scientific point of view to examine them, but I fail to see what it has to do with the inquiry.

3296. *Witness.*] As a matter of science it is one that is highly important to me. I have taken more trouble with axles than any other man in the country, and whilst I am inspecting the engines in order to give an opinion on their other parts, if I could examine the axles I might be able to express an opinion on them also.

3297. *President.*] Well, if they have got any of them in their possession now I don't suppose the Railway Commissioners will object to your seeing them. I do not know whether we have anything to do with the question as to whether the flaws should have been discovered when first they came here. There is no doubt that they were defective, and the question for us to determine is whether the new axles with which they have been replaced are perfect or sufficiently perfect to be run with safety. I do not wish to object to your desire to see the axles, and if you wish to see them in the interests of science I have no doubt the Commissioners will allow you to do so.

3298. *Professor Warren.*] It does not affect the inquiry—that is the only thing.

3299. *President.*] No, it does not affect the inquiry at all.

3300. *Mr. Hoyle.*] Do you consider, Mr. Midelton, that it is in any way dangerous for a trailing wheel on an engine to work loose? If it is allowed to go too far. It is not creditable for such a thing to occur in regard to any engine, and, as far as my experience goes, it is a very rare occurrence. They should be watched very closely immediately upon that taking place. If a defect of that kind is neglected you can only expect something wrong in the end.

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3301. Coming back to the load on the train—you know what our large brake-vans are? The passenger brake-vans do you mean, or the goods?
3302. What is known as our double brake-vans? I know the new lavatory brake-vans.
3303. You know our heaviest brake-vans? Yes.
3304. Do you consider that if the draw-hook—of course I have to keep to the draw-hooks on the engines now—do you consider that if the draw-hook on one of these Baldwin engines broke there would be sufficient brake power on the van to hold a train on 1 in 40—a train weighing 160 tons? Well, it would have to be caught the instant the hook broke in order to save it.
3305. What did you say about the incline?
3306. If it was going up a bank of 1 in 40, I did not say at any particular speed, but I will now say at 12 miles an hour? Well, then, if a Baldwin engine or any other engine, was hauling a train up a bank of 1 in 40 at 12 miles an hour and a hook broke there would have to be reversal of the motion immediately. If you applied the brake the moment the gear broke it might arrest the train's return, but I do not think it would if the wheels were allowed to revolve once or twice.
3307. *Mr. Fehon.*] I must object to this line of examination. It has been already stated, and I beg to point out once again, that every one of our carriages is fitted with an air-tight brake.
3308. *Mr. Hoyle.*] I am perfectly well aware of that; but I will now ask Mr. Midelton whether if the draw gear on a goods train not fitted with automatic brakes was to snap as the train was going up an incline of 1 in 40 at the rate of 12 miles an hour there would be sufficient power on the brake-van to prevent it slipping down? Well, if the guard caught it the very moment that the draw hooks snapped he might succeed.
3309. *President.*] You mean if he caught it, as we used to say at school, "on the first hop," he might prevent the train slipping down the bank again? Yes, if he caught it on the first hop he might do it.
3310. *Professor Warren.*] But you would not like to be in the van? I would not.
3311. *Mr. Hoyle.*] Do you know if compound locomotive engines are a new idea? They are not a new idea in any sense, but they are coming into use more now than a few years ago.
3312. *Mr. Brown.*] The Commissioners have admitted that they only brought out the compound engines as an experiment? The whole lot are experimental engines, as the correspondence indicates.
3313. Which whole lot do you mean? The whole of the Baldwin engines; the Commissioners say so I believe.
3314. *President.*] No, I believe not. As far as I understand it they got these Baldwin engines because they had been disappointed in some English engines which they had ordered, and having been disappointed in regard to the English engines, in order to keep the traffic going during the approaching wool season as the most expeditious and generally the best thing they could do they sent to America for these Baldwin engines. That is their statement, and then in addition to the Baldwin engines they ordered two compound engines for experimental purposes? I understood that the twelve passenger locomotives were said to be imported for running the Southern express and Northern mail passenger trains, and that to that extent they were experimental engines. At the time I asked that my engines should be tested for that purpose but they were not tested which I think was unfair.
3315. *Mr. Hoyle.*] I understood that the compound engines were a new kind of engine, but now I gather that they were tried in England as long as twenty-five years ago?
3316. *Professor Warren.*] Yes.
3317. *Mr. Fehon.*] They are running in England and America very successfully to day.
3318. *Professor Warren.*] And you knew that they would be of use to you here whether they did all that it was said they would do or not.
3319. *Mr. Fehon.*] Yes.
3320. *Mr. Hoyle* (to witness).] You know that there has been a number of failures in the reversing gear and some failures in the break gear. Fulcrum pins have broken, back pins have broken, and rods have broken in connection with the reversing gear. Do you consider, as an engineer, that so many of these parts should have failed, and that there should have been so much trouble with the engines as there appears to have been, considering the short time they have been running? I do not know what there has been in the way of breakages.
3321. *Mr. Brown.*] Mr. Midelton can only tell from what he has seen in the newspapers. If you would put before him the return of breakages that the Commissioners have promised to supply he would no doubt be able to answer your question. You could then get him as an expert to say whether these repairs were fair or unfair considering the age of the engines.
3322. *Mr. Fehon.*] I think we shall be able to give you the returns with regard to the breakages to-morrow. It has taken some time to prepare them.
3323. *Mr. Hoyle.*] We find from evidence here that the boss of the wheels of these engines has worked considerably into the axle-box? Yes.
3324. Do you think that that ought to have been the case so soon after these engines had begun to run? I do not. If the box and the wheel was properly proportioned I should expect them to run at least nine months before there was sign of such a serious thing as that happening.
3325. Do you think it would be a serious defect in these engines then, or a defect in the design or in the material, for a piece of a wheel to work into the axle-box (say) three-eighths of an inch? In nine months.
3326. I think they have been running about six months? If they have been running on the mountain lines you would rather expect the wearing of the box to a large extent; but if I were running them, and they were working into the box unduly, I should feel annoyed with myself that I had not had them properly designed, or that the work had not been according to the design.
3327. *Mr. Fehon.*] Again I submit that there was no design or specification in the question. There was not time to submit a design for these engines; they were ordered by cablegram, so that it does not affect the matter at all.
3328. *Witness.*] I may remark that these engines were ordered in a hurry by cablegram, as Mr. Fehon has just described, but engines could have been obtained more expeditiously, and I say this to show that I am not in any way unfriendly to the Commissioners.
3329. *President.*] That does not matter, Mr. Midelton. It did not affect our view of the question in the least. We have quite plenty to inquire into as it is.

3330. *Mr. Hoyle* (to Witness).] We find that the reversing gear has broken, and that it has been necessary to put new brass brackets on to carry the screw. Do you think now that the reversing gear should have given out so soon as it has after these engines have been running? I do not but I might qualify that by saying that screw-reversing gear was specified in these engines, and that it is customary for the Baldwin Company to put a lever instead of a screw; but as the screw was specified I think it would have been the proper thing to have sent a drawing of what was required; however, if the Baldwin Company has put reversing gear into the engines that I consider defective, I shall not hesitate to say so.

3331. What do you think is defective in connection with the reversing gear? I have not examined it yet.

3332. *Mr. Brown.*] You are coming up to a point at which it will be evidently necessary for Mr. Midelton to see these engines.

3333. *Mr. Hoyle* (to Witness).] Can you go to the sheds at Eveleigh to-morrow morning, for the purpose of inspecting the engines, and come here in the afternoon? Yes.

3334. *Mr. Brown.*] It seems to me that it is the best thing for him to do that before going on any further with his evidence. I want to draw your attention to the fact that the boss of the wheel has been bored out to make room for the increased axle? I think that is a great mistake.

3335. I do not want you to answer that question now. I want you to see the engines first? It is a question which I can answer now.

3336. Then you can answer it better after you have seen the engines.

3337. *Mr. Hoyle.*] Then, under the circumstances, as I have a great many more questions to ask Mr. Midelton, I would suggest an adjournment until to-morrow.

3338. *Professor Warren.*] I have a few questions that I might ask him now.

3339. *Mr. Hoyle.*] Before you proceed, Professor Warren, and whilst the matter is fresh in my mind, will you allow me to say to Mr. Midelton that I want him to examine particularly the valve buckles, the cross-heads, the size of the cylinder, the pistons, the wheels—very particularly the wheels—and, if he can, the axles also.

3340. *Witness.*] In order to do all that Mr. Hoyle has asked me to do, it would be necessary for me to start at daylight and to go on until 12 o'clock (noon.)

3341. *Mr. Hoyle.*] And I want to know the position of the gauge-glass on the boiler.

3342. *President* (to Witness).] As far as I am concerned—I want you, of course, to do all that Mr. Hoyle has asked you—but, for me particularly, to notice the spokes with the so-called cracks in them, where undoubtedly some putty has been put in.

3343. *Mr. Hoyle.*] Engine No. 447 is the one we were looking at, and also engine 456.

3344. *President.*] Engine No. 456, I remember. If you will look at them you will see that there are places where you can put your knife in a little way, and also if they give you a hammer you might sound the spokes.

3345. *Mr. Brown.*] Let us settle how this gentleman is to go down there, and what officer the Railway Commissioners will instruct to meet him.

3346. *Mr. Fehon.*] The best thing is for Mr. Midelton to get a note from Mr. McLachlan, our Secretary, and for us to appoint an officer to meet him.

3347. *Mr. Brown.*] Would it not be better for you to give him an order now, say, that he is to go with Mr. Howe or with Mr. Stanger, or some other officer.

3348. *The Secretary for Railways.*] Here is an order that will answer that question.

3349. *Witness.*] At 9 o'clock, to-morrow morning, I will be at Mr. Howe's office, I dare say that will be convenient for the Commissioners' officers.

3350. *Professor Warren* (to Witness).] We were referring a short time ago to the Baldwin passenger engines as shown on the photograph over there. I want to ask you whether the hauling power of an engine depends upon the weight of the driving wheels? Hauling power depends upon the weight upon the driving wheels and the cylinders, and the pressure, of course.

3351. Yes; but I am assuming that the proper proportion is maintained between adhesion and driving power. Supposing you have a weight of 45 upon the driving wheel and you reduce it to 43 tons? That is too little.

3352. But never mind that? Then she will slip and not haul at all.

3353. But supposing the engine power is adjusted to the weight upon the driving wheels, what then? If the weight is adjusted to the power of the cylinder she will haul the full load that was intended when you designed her, whatever that may be. If she is loaded too lightly as regards the cylinders she will slip. Many engines are over-cylindereed—that is, the adhesive weight is not sufficient for using up the cylinder power. Here we have a case, and the engine is too heavy for our rails, yet not heavy enough for the reasons given.

3354. But would not the engine haul so much less in the proportion that 45 bears to 43? Yes; just the same as a horse with a man on its back and a man off its back. If you have a horse in a dray it will pull more if the load upon its back is increased by the weight of the shafts as against traces.

3355. That is to say, that the reduction of the weight upon the driving wheels would reduce proportionately the power of the engine? Decidedly.

3356. Your own engine was tested by Mr. Roberts, of South Australia, and also by Mr. Alison Smith, was it not? Yes; the early one was tested in 1887.

3357. The loads that it would draw up the Lapstone incline were demonstrated by that test? Yes.

3358. And the speed was taken during the test? No, I do not think the speed was taken; it was a question who would get there first. I contended that Mr. Scott's engine was wrong and I have proved it.

3359. Mr. Hoyle was asking that your engine should be tested as well as the Baldwin engine? Yes.

3360. *Mr. Fehon.*] We test it every day.

3361. *Witness.*] It has been tested for the last five years, and it has done the work of the country for long before these ten-wheeled engines came here.

3362. *Professor Warren* (to Witness).] Can you give any reason why your engine should be tested? Yes; because the weight is properly adjusted according to the cylinder power. It will pull more in proportion to its cylinder power than the Baldwin engine. It will pull its full load, which I consider the Baldwin engine will not do without the use of sand.

3363. *Mr. Fehon.*] We have never questioned the power of Mr. Midelton's engine to draw its load. It is a very good engine, and was the most powerful engine we had before the arrival of the new engines.

3364.

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3364. *Professor Warren.*] My object in asking the question was to find whether Mr. Midelton, as the designer of the engine, could offer any strong reason why the test should be made. Otherwise, I should be obliged to oppose it, as I do not see what useful purpose it serves in connection with this inquiry.
3365. *Mr. Fehon.*] We should object very strongly to anything of the sort.
3366. *Witness.*] My reason for asking that the test should be made, is that the weight on the driving wheels is in proportion to the cylinder power of the engine, and is properly adjusted. That is not the case with the Baldwin engine, or with the new Manchester engines, and I want to prove that I am right, and that they are wrong.
3367. *Professor Warren.*] Yes; but we are not trying your engines, the Baldwin engine was ordered to do certain work, and we want to ascertain whether it will do that work? The new Manchester engine was brought out for a similar purpose, and indeed it was brought out to do more work. If I might make a suggestion, I should like the Baldwin engine and the new Manchester engine tested as Professor Warren suggests, and then to have my own engine tested against both.
3368. *Mr. Brown.*] My mind is not made up with regard to the necessity for these tests.
3369. *Witness.*] It is the most important question before the country.
3370. *Mr. Hoyle.*] I shall press for these tests afterwards.
3371. *Professor Warren.*] I shall ask for whatever tests I think necessary.
3372. *President (to Mr. Hoyle).*] Have you got any other witnesses this afternoon?
3373. *Mr. Hoyle.*] No, I have not.
3374. *President.*] I do not want to hurry you in the least, but how long do you think your case will take?
3375. *Mr. Hoyle.*] Well, I suppose now, in consequence of the new development, it will take the whole of this week and probably the best part of next week.
3376. *Professor Warren.*] I think we should meet oftener?
3377. *Mr. Hoyle.*] If you meet oftener it will be a very serious matter to me. I will point out to the Commission that I have my business to look after, and that I have to employ a man to take care of it in my absence.
3378. *President.*] If we do not meet oftener and bring this matter to a conclusion it will be a very serious thing to me. I also have my work to do, and I cannot get anyone else to do it for me.
3379. *Mr. Hoyle.*] I should suggest, Mr. President, that we should meet earlier.
3380. *President.*] Professor Warren is not able to attend earlier than two o'clock; he has his lectures to attend to. So far as I am concerned I should feel inclined to meet more frequently, but Professor Warren cannot meet earlier.
3381. *Mr. Brown.*] We must also consider the officials. They are already working fifteen hours a day.
3382. *President.*] Have you any other witnesses that you could call now, Mr. Hoyle?
3383. *Mr. Hoyle.*] No, I do not think that I have.
3384. *President.*] We are desirous of meeting you in every way in our power, you will understand that; but can you give me any estimate of how long a time your case will last. It seems to me, as things are going at present, that we shall have a lease of this room for a long time.
3385. *Mr. Fehon.*] Driver Moses is still on the premises.
3386. *Mr. Hoyle.*] I have already stated the reason why I cannot call Driver Moses.
3387. *President.*] If what you refer to as being necessary for you to read before calling Driver Moses is in the original depositions, I have got them. They have been sent down from the Justice Department.
3388. *Mr. Hoyle.*] I want to ask Driver Moses certain questions, and I should like to see the depositions before doing so. As far as I am concerned, I wish to get through this matter as soon as possible, but I have the public to consider as well as myself. However, if the Commission will intimate to me they do not think there is anything in my charges, I am prepared to give the case up at once.
3389. *President.*] On the contrary, that would be the strongest reason for going on, to allow you to finish your charges. If we thought there was nothing in the evidence that you have called so far, it would be very wrong of us to stop you. I do not know what view any other member of the Commission has. I only know what my own view is, and at present it is a very undefined one. The fact that you have so far not made out your charges would be the last reason for stopping you.
3390. *Mr. Brown.*] That would never do, Mr. Hoyle.
3391. *Mr. Hoyle.*] I am very anxious to meet the convenience of the Commission in this matter.
3392. *President.*] We quite understand that. Mr. Midelton will inspect the engines to-morrow morning, and attend here to continue his evidence at 2 o'clock in the afternoon.

WEDNESDAY, 4 MAY, 1892.

[The Commission met at 2 o'clock in the Board Room, Colonial Secretary's Office.]

Present:—

F. E. ROGERS, ESQ., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

ALEXANDER BROWN, Esq., J.P.

3393. *Mr. Hoyle.*] Before Mr. Midelton comes in I wish to ask the Commission if they would ask the Engineer-in-Chief to supply me with a section of the rail or rails now in use between Wallerawang and Bathurst. I wish to have a sketch of the sections of these rails.
3394. *Mr. Fehon.*] That comes in Mr. Deane's department, and he is a Public Works officer, and is not under the control of the Railway Commissioners.
3395. *Professor Warren.*] Would it not answer our purpose if the Secretary to the Railway Commissioners sent a letter to Mr. Deane asking him to supply the particulars you desire.
3396. *Mr. Fehon.*] Yes, I think we could do that.
3397. *Mr. Hoyle.*] There is one other matter I would like to bring before the Commission before going any further. I have called Mr. Midelton to give evidence before this Commission, and as he is outside the Railway Department, I have thought that, under the circumstances, he and other gentlemen whom I may call, being professional men, and being put to loss of time and inconvenience in coming here, the Commission might make some arrangement to give these gentlemen some recompense for their attendance, and as this is a matter which the Commission might have to consider, I thought it would be well to raise the question now. I think that in the case of Mr. Midelton such an allowance as I have mentioned might be made;

3398.

3398. *President.*] Very well, Mr. Hoyle; we shall see about it.

3399. *Professor Warren.*] Quite so. Mr. Midelton has been instructed by the Commission to do certain things, and we shall take your suggestion into consideration.

Thomas Midelton further examined:—

3400. I wish to ask the permission of the President to kindly allow me to correct an error I made yesterday with regard to the newest Manchester engines. I said they were upon separate springs, but I now find on closer examination, made by me this morning, that the driving and leading springs are compensated. That was alluded to yesterday in looking at the photographs. The trailing wheels, I may mention, are separate as I first said. Mr.
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3401. *Professor Warren.*] The two first driving wheels are, you say, compensated, and the wheels behind are on separate springs? Yes, which is rather worse, I think, than what I said before.

3402. *Mr. Hoyle.*] When we concluded yesterday afternoon it was arranged that Mr. Midelton should visit the Eveleigh shops and inspect the Baldwin engines now under inquiry. I should like to know, Mr. Midelton, if you have made that inspection? Yes, I have seen engines 456 and 447 this morning.

3403. In examining these engines perhaps it would be well if Mr. Midelton would state his opinions about them, without interrogation? The first question alluded to was, I think, the valve buckles. I have carefully examined a broken buckle from No. 456 or 447, I do not clearly remember which, but it was one of the class. On first appearance it struck me that the buckle was light; as to the quality of the material I could not see since it was quite rusty in the fracture. Comparing that buckle with the English designed buckles, I consider it to be light, but there is a set-off against that in the fact that as the slide valves are "balanced" in the American engines, these buckles, compared with the English buckles, appear strong enough. In the English engines the buckles are very strong, because the slide valves are not "balanced." Making them light must be looked on favourably on account of the valve being "balanced," but even under these conditions I think they are a little weak. I should have made them stronger, but that will perhaps be rectified a little later on. With regard to the reversing gear as originally constructed, the fulcrum pin of the main lever is decidedly defective. The bearing portion of the pin is large enough for the stress, but it was reduced in diameter where it screwed into the bracket fastened to the boiler. That reduced its strength and made it very weak. It should have been slightly larger if anything. This, I understand, has been rectified here and acknowledged by the makers.

3404. *President.*] The defect in the pin of the reversing gear was the only defect you found in that gear? Yes; that was an original defect, but it has been made right by the company. With reference to the piston cross-heads of the passenger engines, they are fitted with gun metal slide blocks, which, I believe, will be found to wear very rapidly. I should certainly object to them. It is a detail certainly. Some engineers consider particular material best, some prefer gun metal, and some cast iron. I prefer cast iron. But I do not consider that a very grave defect. I am rather surprised that the company have put in such metal, but I suppose they have some reason for it which I do not understand.

3405. With regard to the pistons? They are not excessive in weight. I refer to the passenger engine. I had not an opportunity of looking at the goods engine, but I think they would be rather heavy on the slide bar when the engines run without steam, the connecting rods being so very long.

3406. *Professor Warren.*] Gun metal would be dearer as a matter of fact? Yes, and I think it would wear faster.

3407. So that it would not be put in for economy, I suppose? No; I imagine it has been put in to test some mixture of metal. It may be Ajax metal or some similar material—a patented article perhaps. For my own part I prefer cast iron.

3408. *Mr. Fehon.*] I would call the attention of the Commission to the fact that these are all little matters of detail in connection with the building of the engines, and not affecting the question of their being "faulty in design." Those are the words used by Mr. Hoyle, I think, in his charge. It is a matter of opinion between makers which they will use. One may adopt one design, others another.

3409. *President.*] We do not care about any other charges except that these engines are defective, and the other matters we are required to investigate by our commission. It does not seem to me that this evidence with regard to the metal shows that the engines are at all defective; on the other hand, if a dearer article had been put in, it would seem to be for some special purpose of the makers.

3410. *Professor Warren.*] I think Mr. Midelton's evidence shows that this is a matter of opinion, and that this was not done for economy; however, it is obviously a matter of opinion. (*Witness.*) I examined a piston; there was a spare one for a passenger engine; it is not too heavy for a cylinder 21 inches in diameter, but an effort has been made by the company to reduce the weight of pistons, and a lighter kind has been recently designed, so that the importance of reducing the weight was recognised. All engineers recognise the importance of reducing the weight of the piston, crosshead, &c.

3411. *President.*] Well, there is nothing wrong with it? No, I did not see anything wrong with it really. The axle-boxes I saw did not show much with regard to lateral wear; I asked if they had run over the mountains, and I was informed that they had run in the Bathurst district. The axle-boxes had a tendency to wear into the wheels, but not unduly in the engines I saw. I know that the boxes do wear unless they are properly designed, looked after, lubricated, and so on. I think it is an unnecessary and improper expenditure to put brass axle-boxes on the engines.

3412. *President.*] We do not care about that. It is not necessary to enter into the question whether the Commissioners have gone to more expense than was necessary or not; we want to know whether these Baldwin engines are defective or not.

3413. *Witness.*] I have no doubt the leading coupled wheel axle-boxes will wear fast on the mountain curves, but not perhaps on the Northern and Southern lines, but any box will wear more on the mountain road than on the other portions, they may wear perhaps more than others from the nature of the general design, and I think that was a departure not justified in any way. I examined the swinging links of the bogie, and they hung perfectly vertical; that is objectionable according to my experience. The firm in question and others I believe have experimented some twelve years now, on the question of links, whether they should be hung outwards, inwards, or vertically. I think this departure in hanging these links in a vertical position is not wise, and the engines in running round an 8 or 10 chain curve at 30 or 35 miles an hour would in consequence have an undue tendency to fly off at a tangent from the curve, and wear the flanges of the leading coupled wheels unduly.

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3414. *Professor Warren.*] You mean it increases the oscillation in front? Yes, on curves and straights, through hanging the links vertically, I think the engine would be likely to wander in front, and on the curve she would go to the outside rail of course, whereas if the links were hung in the old way the movement would be less and the engine would go as required theoretically.

3415. Then if there were any defect in the road the engine might be likely to leave the rails, or more likely than if the links were hung obliquely? Yes, I think there would be more likelihood of its doing so than if they were hung in the old manner. The Manchester engine links are slightly oblique, but not so much as the American. The present Baldwin engines are hung vertically, but all previous engines sent here have the links hung as I prefer, excepting Mr. Scott's ten engines, which were hung the reverse way. I have found that the links hung as in the original engines are the best. I examined No. 456 engine, wheels, and axles—the wheels minutely. The manufacture seems to be fairly good for a new article and a new system. They are not so nicely made as a mechanic would expect so far as regards finish. The "ring" of the material seems to be fairly good. There are defects in the way of "galls," and crevices, and so on, but not in the way of weakening the wheel. On the whole they seem to be fairly well manufactured considering the new process; but at the same time they are decidedly light for that class of engine—the arms are further apart than is usual. I compared them with wheels of English design. Making that comparison I consider that in these engines the arms are too far apart.

3416. *President.*] By the arms I suppose you mean the spokes? Yes, and that tends to weaken the wheel. I do not say they are too weak for the purpose, but they are weak in proportion. The design is not symmetrical, nor what I think the company should do with their experience of cast-iron. The wheels are certainly light and hardly up to the thickness and size I should like to see them for that weight of engine. With reference to the bosses of the wheels they are particularly light, the metal surrounding the axle being only $2\frac{1}{2}$ inches, whilst in the English make they are from $3\frac{1}{2}$ to 4 inches; the English practice is to make them too heavy, and the American practice—in this instance—is to make them too light; I should prefer to have them between the two. They are certainly light as regards the metal round the axle, and also the metal round the crank pins; I dare say that in heavy pulling defects will develop; it will be found difficult to keep the wheels tight on the axles—they may get loose on the axles.

3417. *Professor Warren.*] With regard to the flaws in the spokes I suppose you sounded the spokes in each wheel? Yes, with a hammer; some of them sounded rather dull, as if cracked, but that was an exception—about one in each wheel; there were signs of bad welding, and the material of the wheels seemed to be imperfectly distributed.

3418. In some of the spokes did you notice an apparent flaw so that you could put a knife in them? No, I looked very carefully, but I found flaws in the balance weight.

3419. And did you see no crack? No; I asked Mr. Howe to point them out to me, but I could not see any in the wheels of No. 456, and in No. 447 the latter wheels were under the engine and I could not see so well; I failed to discover cracks alluded to by the President yesterday as being in the arm. Mr. Howe pointed out to me one little crack near the rim, but I did not think it very important.

3420. *Mr. Brown.*] You made a fairly careful examination? Yes, considering the time I had at my disposal.

3421. *Professor Warren.*] You did not consider the spokes likely to fracture in the places you have mentioned? It is necessary to be very cautious, and I think there will be flaws develop as the wheels are used. If I am right I may congratulate myself on the correctness of my view. I am afraid something may develop later on. They are inappropriate wheels for the class of engine, and I think the company will agree with me in what I have said, and make them heavier in future. The company were especially asked to reduce the weight of the engines; in the letters to the Railway Commissioners the Baldwin Engine Co. protested, so that they are justified in reducing the weight of the wheels in complying, as far as possible, with the specifications sent here for consideration. I looked at the water gauge-glass, and I am told by a Government representative that the water-gauge is in its original position, but an additional gauge had been placed on the engines in order to give the driver an opportunity of watching the levels. I could not say at what height it has been placed with reference to the top of fire-box, but I was told it was placed properly; that could only be found out by measurement, but, of course, I could not do that.

3422. *Mr. Brown.*] On the whole your examination shows that these engines are a rough but fairly substantial job? Well, I have stated my opinion and enumerated the various details examined.

3423. *Mr. Brown.*] Have you examined them sufficiently to say that there are defects in the engines which render them unsuitable for our railways? No; but I say they are too heavy for our roads, and therefore unsuitable. I did not see anything in the wheels in the sense which defect is understood, they are not the class of workmanship one would expect from the Baldwin Co., but it is to be remembered the work was done in a hurry; indeed I know the job was done in a hurry. On the whole they seem to me to be a fairly good job, but they are not right.

3424. *President.*] That is to say they are not finished like the Beyer and Peacock engine that we saw at Eveleigh—there is not the same finish upon them as upon the English engines, but supposing the permanent-way to be suitable for them do you think that the wheels of the engines are defective? I think they will show defects in the course of time. I think there will be development which we would prefer not to have.

3425. *Mr. Brown.*] Did you examine the bogie wheels where they had been bored? Yes; and I think it a most indiscreet, injudicious, and wrong thing to do. To bore out the wheels to put larger axles in is a most stupid thing to do, the friction is greater now than before with the same weight, as the circumferential speed is greater.

3426. *Mr. Fehon.*] Has it not been the practice of the Department within your own experience to put on axles in this way and then shrink on an iron ring? It has been the practice of my successor and predecessors, but I would not have allowed it; it has many times been done wrongly, and not for reasons that could be justified.

3427. It has been done with your own engines, I believe? Yes, the first ten, and I actually saw one of the ten from Dubs in which a larger axle had been put, and brass boxes had been put in, quite unnecessarily.

3428. *Mr. Brown.*] Then you don't agree with it? No, I do not.

3429. But it was the practice of your predecessors? Yes.

3430. *Professor Warren.*] How much has the axle been increased in diameter? I think from 5 to $5\frac{1}{2}$ inches; I think that would be the dimension.

3431.

3431. Assuming it to be $5\frac{1}{2}$ inches? I do not quite know the dimension, but it is a considerable increase.
3432. Well, assuming it to be that you say that the friction has been increased, that is to say, the friction would be increased in proportion to the radius, the radius has been increased a quarter of an inch, the friction I suppose would also be increased by the extra weight of the axle? The weight of the axle has only been slightly increased—due to the extra diameter, the weight on the bearing is the same.
3433. The friction is greater? It was less than it is now.
3434. The load upon the wheels will be about $3\frac{1}{2}$ tons? Yes.
3435. So that it is a very small degree of weight? Yes, but it is an increase of working expense.
3436. In boring out the boss to a larger diameter in order to get a larger axle in, you have a larger journal, the increase in surface would be proportional; for at all events it would mean a larger brass and a larger surface, the pressure per unit of area would be less than before, and there would be a tendency to heat? Would be greater;—how do you justify that?
3437. In this way, you are trying to show that the speed does not affect it? No, I am not.
3438. Well, I must misunderstand you. I think your doctrine is that if the axle is increased in diameter the speed of the axle, on account of the greater circumference, is faster. Why not increase the journal up to the size of the wheel? You have a better bearing perhaps, but there is an increase of friction. I consider that an axle of 5 inches is better than $5\frac{1}{2}$ inches. Axles are made larger in diameter now for strength and torsional resistance.
3439. Your evidence is that by increasing the diameter of the journal you increase the friction? Yes; due to the extra speed.
3440. *President.*] In this way, if I take this pencil and turn it round, then in order to turn round a bigger one in the same time the circumference would have to go faster? Yes; and the consequence is the friction and the consumption of oil is greater, I think it would be a very unwise and unnecessary step to take.
3441. *Professor Warren.*] But have the axles been increased also throughout, so as to give extra strength except in the journal? I do not know whether they were increased, but they were quite large enough. It is a ridiculous alteration, and I think a most injudicious one. These tender axles are of iron, mine are steel.
3442. Then these axles you say have not been increased to give extra strength, do you know why? I do not know why, but it seems to me a most unwise thing to do, and I would like to know the reason why it was done. I know of no reason except that it was to alter things that were right before.
3443. They ran hot I believe? That may not be the fault of the brasses or the axles, it was perhaps the fault of some one connected with the supervision of the engines.
3444. If the axle had flaws in it, would that have any effect? These steel-axles have no flaws.
3445. But assuming there were flaws in the axles through which dirt would come out—would no that make the axles run hot? Yes; I should think it would increase the friction.
3446. Well, we had evidence to that effect?—
3447. *President.*] Do you refer to the heating of the bogie-axle of the Baldwin passenger engine? No, I am referring to the Dubs engines.
3448. Oh, I understood you were referring to the Baldwin engines; we do not want to know anything about any engines but the Baldwin.
3449. *Professor Warren.*] I also thought he was referring to the Baldwin engines? No; I meant the Dubs' engine.
3450. *President.*] We have evidence that the axles on the Baldwin engines were running hot, and it was said that this was because some slag worked out, got through the metal, and increased the friction; well, do you say that this was due to bad management, or want of supervision, or is it an inherent defect in the axle itself? I saw a Baldwin axle this morning which had laminations in the surface, such as I described yesterday; if the dirt came from these laminations it would tend to make the boxes run hot, but whether it is so or not I cannot say, but seeing that these axles showed laminations when put in the engine, it was for the driver to look particularly after them to see that they did not run hot. As to the axle of No. 447, Baldwin engine, if I had been superintendent I do not think I should have allowed it to go under, judging from the appearance of it; it was a 5-inch axle. I also saw an old engine of Stephenson's with iron axles, and two—the leading and trailing—had laminations in them. The crank axle was of steel, and looked very good indeed. I also saw a Beyer and Peacock iron axle, it also had laminations; Stephenson, Beyer and Peacock, and Baldwin engines, with iron axles, each had laminations, but they were not so defective that I would reject them; but with regard to the Baldwin engine bogie—5-inch axle—I would hesitate before I put that axle under the engine.
3451. Will you tell us now about the Baldwin engines;—the boxes of the Baldwin engines have been increased in size? Yes.
3452. Do you consider that injudicious? Yes, I do. I think it a wasteful expenditure.
3453. Well, whether it was wasteful or not, that is not the question to determine. Did this boring out make anything unsafe;—has it left the boss too small? No, I do not think it has been made unsafe.
3454. *Professor Warren.*] It has merely increased the friction in the manner you have described before? Yes.
3455. But the axle is not so likely to break? If the axle is 5 inches and good, it is not likely to break.
3456. Have you any other point to make? No, I think these remarks cover all I was requested to investigate.
3457. *Mr. Brown.*] We were told, Mr. Midelton, that certain alterations were made in these engines at the request of the officers of the Government. You will find them contained in the first part of the correspondence.
- (A.) "The engines require, however, the following modifications:—Our coal being good, the grate area might be somewhat reduced, lessening the weight on each driving-axle to not exceed $14\frac{1}{2}$ gross tons, or 32,500 lb.
Our water being bad, the fire-box should be copper, and the tubes brass.
No bell is required.
Hand-brakes and Westinghouse automatic are wanted on all driving and all tender wheels.
Screw reversing-gear is wanted.
Trailing sand-pipes behind rear driving-wheels are wanted.
The sand-boxes would be preferred on or under the foot-plate, instead of on top of boiler.

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Bushes are preferred on coupling-rods.

The connecting-rod would be preferred with adjusting cotters, and split brasses as usual, but without straps.

The capacity of the tender should not be less than 3,600 American gallons.

The gauge of road is 4 ft. 8½ in.

The extreme height of chimney should not exceed 13 ft. 6 in.

The extreme width of engine should not exceed 9 ft. 6 in., and, if possible, should not exceed 9 ft. 3 in."

I may explain that they were talking with regard to an engine described in the *Railroad Gazette*, 18th June, 1890. A conference of Government officers, who had that engine before them as a pattern, was held, and they agreed that this engine appeared to be suitable and sufficiently powerful for our requirements if certain alterations were made, and they consist of what I have just read to you. What I wish to call particular attention to is the first part,—“Our coal being good, the grate area might be somewhat reduced, lessening the weight on each driving-axle, to not exceed 14½ gross tons, or 32,500 lb.,” and the next is that the extreme width of the engine should not exceed 9 feet 6 inches, and if possible, should not exceed 9 feet 3 inches. Now, I want to know from you if these modifications would interfere with the efficiency of the engine? Yes, and it saddles the whole responsibility on the manufacturer instead of on the person drawing the specifications.

3458. *Mr. Fehon.*] We had no specifications at the time? You had the *Railroad Gazette*.

3459. *Mr. Brown.*] I am not quite satisfied upon this point. What I want to know is, whether the amendments made by the officers, and which I have read to you, would interfere with the efficiency and speed of these engines, because I understand that the Company would not guarantee the speed of the engines if the alterations were made. I wish to obtain your opinion, and you have said that it would interfere with the efficiency and speed of the engine, and you also say it throws the responsibility on the makers.

3460. *Witness.*] It is unfair to throw such responsibility on the makers, seeing that the Government officers had the design and specification of the Baltimore and Ohio engines before them.

3461. *Professor Warren.*] Mr. Brown has asked questions with regard to the reduction of speed;—you said yesterday that the decreased weight on the driving-wheel would reduce the speed in proportion to that reduction? I said it would reduce the tractive force. The Baltimore and Ohio engine is, in my opinion, rather light also. To ask the Company to make our engines lighter is to ask them to make the engines still more unfit for our lines.

3462. The weight on the wheels could only reduce the hauling power, so that the hauling power would be reduced in proportion? Yes; the engine for the Baltimore and Ohio Railway is light, according to my experience, for the cylinder power, and to ask the Company to make a lighter engine still, and yet make it like the Baltimore and Ohio engine, is rather a paradox to me. I do not see how it can be done.

3463. Is the cylinder power the same as the Baltimore and Ohio engine? No; the latter has 2 inches larger stroke, and the tractive force is greater.

3464. There is not the same adhesion? No; the Baltimore and Ohio is the better of the two. The Railway Commissioners' officers wanted an engine like the Baltimore and Ohio. They specified for something else, and they got what they asked for. They wanted a lighter engine, and specified material which would make it heavy.

3465. *Mr. Brown.*] I think you have said that the road was not strong enough for these engines; well, do you know Dr. Williams? Yes. Would he not be qualified to give an opinion on that question? Yes, if he had seen our road lately, I would not ask for a better opinion.

3466. Well, supposing he says—“We recommend you to take a Baltimore and Ohio engine, because we believe it will be suitable for your roads.” Do you consider that would be a reliable opinion? I do not think he would do so, unless he actually knew the actual dimensions of our rails, &c. He might say that he believed our roads to be suitable, but he would not know it. It was the duty of the Government to furnish the Company with the weight of the rail, and all particulars, and then he might have given an opinion which would be absolutely safe to act upon.

3467. You say that these gentlemen—the officers of the department—in making the amendments I have read, committed a mistake? Yes, there is no doubt about that in my mind—they made a grave mistake.

3468. *Professor Warren.*] You have given us a limited weight on the 71-lb. rail, I think? Yes, all the authorities agree on that point, Molesworth and others. Mr. Whitton, Mr. Burnett, myself and others all agree upon this point, until my successors came in, and they have increased the weight.

3469. *Mr. Brown.*] I am going to read part of the correspondence from the Baldwin Engine Company about the suitability of these engines to our roads. These gentlemen, writing on the 10th October, 1890, say that:—“Basing our estimates on Dr. Williams' experience with the engines shipped per “Niobe” in 1879, we are willing to undertake the erection under steam at 300 dollars each, exclusive of cost of shop space.” From this you will see that Dr. Williams was there at the time, and that they were able to consult with him, for they say subsequently, “As we understand that the permanent-way of the New South Wales railways is of a much more substantial character than the Baltimore and Ohio railroad, we see no reason why the engines built for the latter should not be adopted entire.” Do you not think that Dr. Williams was speaking from an intelligent and authoritative point of view? Yes; I think he was doing quite right; he was endeavouring to induce the Government, from his experience, to adopt the Baltimore and Ohio engine intact, and, from his knowledge gained here, he estimated that our permanent way was strong enough to carry these engines. He does not say from his own knowledge that it is, but he thinks so.

3470. But I understood you to say that the Baltimore and Ohio engines would be too heavy, how do you reconcile that with this recommendation? Seeing that the Government officers ask for a lighter engine than the Baltimore and Ohio this is *prima facie* evidence that they thought our rails not heavy enough, and they should have known that the reduced engines would be too light. Dr. Williams recommends the heavier ones. I do not think that Dr. Williams, with all due deference to his opinion, from his experience gained here twelve years ago, leaving here in 1878 or 1879, could carry in his memory the condition of our road up to the present time; he simply advises the Government to do what he thought best.

3471. I suppose that he knew that our rails were 71-lb. or 75-lb.? Yes; I dare say.

3472. *Professor Warren.*] Do you think he was wrong in his opinion? No; I think he was doing right, speaking in Philadelphia as he was, with the object of introducing business in the best way.

3473. *Mr. Brown.*] You do regard Dr. Williams as a reliable authority? Yes; his visit to these colonies was one of the best things that ever happened to them. Had his advice been fully acted upon, we should have benefitted much.

3474. *President.*] What do you mean by "talking from that end from a business standpoint?" The Company say, we fear it will cause disappointment to you if you have the engines much lighter. You had better accept the Baltimore and Ohio engine intact.

3475. *Mr. Brown.*] He says, I think your permanent-way is suitable for these engines.

3476. *Professor Warren.*] I take it your evidence shows that both engines were too heavy? Yes; the Baltimore and Ohio engine was too heavy, but they asked for a duplicate of that engine, "only that it should be lighter," and Dr. Williams is consulted, and he says he thinks the heavier engine would be suitable for our roads and the altered engine end in disappointment.

3477. *Mr. Brown.*] But he says the Baltimore and Ohio engines—that is, these Baldwin engines—are suitable for our permanent way;—is he not a competent man, with a knowledge of our railways? Yes; but he only expresses an opinion based on what he believes.

3478. *Professor Warren.*] What is the practice in America, from your knowledge, with regard to the weights on the driving-wheel and the rails;—is it a fact that the Americans put heavier weights on their wheels than the English think prudent? Yes; if you read the last number of *Engineering News* you will see the folly of doing that. In the Eastern States that is a thing of the past.

3479. The March number? Yes; I think there is an article on the very question there. They state that the Baltimore and Ohio road is a very heavy one, 85 lb. to the yard, steel rails, Vignoles section.

3480. The Baltimore and Ohio railroad? Yes; they are 67 and 85 lb. to the yard rails.

3481. *Professor Warren.*] Are the Baltimore and Ohio engines running on a 67-lb. rail? I do not know—I question it very much; speaking of course of those we are now considering.

3482. Which do you mean, the express or the ten-wheel? If you ask me whether the ten-wheel engine is running on a 67-lb. rail I should say I do not think it does. If it does the sleepers must be very close together. In any case that fact, if it is a fact, does not show that it is the right thing to do.

3483. The American practice would justify a heavier weight being put on the rails; is not that a fact? Yes; they have used heavy engines on light rails to their cost, and I refer you to the article in *Engineering News* to justify what I say.

3484. *Professor Warren.*] The general tendency is to use heavier rails, following the English and German practice, is it not? Yes; in America they now go in for necessary heavy rails.

3485. *President.*] Dr. Williams, I understood you to say, was out here? Yes; he was here in 1878.

3486-7. *President.*] Will you look at page 5 of the correspondence, about eight lines down, it is said, "We presume our supply of September 5th made this clear. Basing our estimates on Dr. Williams' experience with the engines shipped per 'Niobe,' in 1879, we are willing to undertake the erection under steam at 300 dollars each, exclusive of cost of shop space." What do you understand by those words, "basing our estimates on Dr. Williams' experience, that the engines shipped per 'Niobe,' in 1879, we are willing to undertake, &c."? That refers to the cost of delivery only.

3488. *President.*] I cannot answer questions; I want you to do so. Will you now go down about twenty-five lines further in the next paragraph, or the paragraph after. It says:—"As we understand that the permanent-way of the New South Wales railways is of a much more substantial character than the Baltimore and Ohio railroad, we see no reason why the engines built for the latter could not be adopted entire." Who could they understand that from except it was Dr. Williams? They say, "as we understand that the permanent-way of the New South Wales railways is of a much more substantial character than the Baltimore and Ohio railroad." Who could tell them that but Dr. Williams? If he had said distinctly: "as I know that your permanent-way is more substantial," then I could understand it; but it is not worded in that way.

3489. The Baldwin engine people are speaking, and they say: "as we understand that the permanent-way of the New South Wales railway is of a much more substantial character than the Baltimore and Ohio railroad." Who could they understand that from but Dr. Williams? No one.

3490. Then it is quite clear that he believed the permanent-way of this Colony was more substantial than that of the Baltimore and Ohio railroad. Yes, I suppose that is the inference.

3491. If so, surely the Commissioners did no wrong in leaning to the right side by asking for an engine of a lighter type than the Baltimore and Ohio engine? Yes; but they say to wind up: "we should be gratified if, on further consideration, this is decided upon"; asking again for the adoption of their Baltimore and Ohio engine.

3492. It is stated in this letter: "We see no reason why the engines built for the latter"—meaning the Baltimore and Ohio railroad—"could not be adopted entire." I suppose that it would be more trouble to the Company to alter the engines to the design required in the modifications than to send out the original Baltimore and Ohio engine? Yes; and the Government officers actually asked the Company, after they had reduced the dimensions, to reduce the price also.

3493. We have nothing to do with the price, but assuming that Dr. Williams was a competent person, and you admit that? He is an eminent man, the head of the firm.

3494. Well, if he told them that our permanent-way would do for the Baltimore and Ohio engines, what wrong did the Commissioners do in asking the Company to make something lighter for them? They did this wrong;—if they knew he was right in his opinion there was no necessity for any alteration. Dr. Williams' firm said: "We should be gratified if, on further consideration, this is decided upon," meaning if they would take the Baltimore and Ohio engines it would be more satisfactory for everybody.

3495. But what wrong did the Railway Commissioners do if the permanent-way could carry a heavier engine, and they order a lighter one? What wrong was there?

3496. Yes, what impropriety of conduct was there? That is what we have to consider? The wrong they did was to reduce the efficiency of the engine.

3497. If the permanent-way would have carried one of the ordinary Baldwin engines, was there any harm done in asking the Company to make a similar kind of engine, only a little lighter? The wrong has been done in asking the Baldwin Company to build a heavier engine than we had before. They saw that the Baltimore and Ohio engine was too heavy for us, and they asked the Company to make a lighter engine.

3498. Yes, I know that is your view, but do you agree with Dr. Williams? The Baldwin Company was asked to build these engines in a hurry; they say, "You appear to want a Baltimore and Ohio engine, we have

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have duplicates of these, and hope to induce you to take them intact, but you must decide whether you will have them intact or whether we shall make them lighter"; and they preferred the lighter engine—the altered one.

3499. If Dr. Williams is right in telling them that the permanent-way here would carry an ordinary B. and O. engine, supposing that the Commissioners here and the Baldwin Engine Company took his advice, if he said they were substantial enough to carry an ordinary Baldwin Engine, was there any harm done by the Commissioners in saying, "We shall not have an ordinary Baltimore and Ohio Baldwin engine"? If he said so, but he does not say so. He gives the Government the best advice he can give.

3500. Well, what do you understand by that sentence, "As we understand that the permanent-way of the New South Wales railways is of much more substantial character than the Baltimore and Ohio railway, we see no reason why the engine built for the latter could not be adopted entire;" do you think they understood that from Dr. Williams, do you not think they did; and then they say, "we see no reason why the engines built for the Baltimore and Ohio railroad should not be adopted in New South Wales? Yes; they say, we see no reason why we should not take the Baltimore and Ohio engines intact.

3501. Most naturally they do so; but I suppose they had them in hand;—but what we want to know is whether the engines ordered were suitable to the permanent-way of the Colony or not? Yes.

3502. You say they are unsuitable for the permanent-way, do you say that for any other reason than that they are too heavy? Yes; they are too heavy.

3503. Well, do you not see that it is only fair that we should also know what the gentleman who was on the spot and had seen our railways, and who was, as you say, a most eminent man, had to say? But since Dr. Williams had been here steel rails have come into use. Dr. Williams, as I say, advises his firm in this correspondence; and his firm says, "We should be gratified if, on further consideration, it is decided upon." The Government rejected his advice.

3504. He would be gratified, no doubt, if the Government did not depart from the standard of the Baltimore and Ohio engine; but the Company said, "As we understand that the permanent-way of the New South Wales railway is of a much more substantial character than the Baltimore and Ohio railroad." Now I want you to say what harm you think the Commissioners did in ordering a still lighter engine, when their road was even more substantial than the Baltimore and Ohio railroad. Did you not say that some of the rails on the Baltimore and Ohio line weighed 67 lb. to the yard? Yes; and some 85 lb. to the yard.

3505. But the road for the purpose of the engines going over it would be no stronger than the weakest part of it; do these Baldwin engines run over the 67-lb. rails? I have not said so. The Commissioners, I believe, are going to prove that. I leave it to the Commissioners.

3506. Where did these engines run between? Between Philadelphia, Baltimore and Washington.

3507. Is there any part of that road laid in 67-lb. rails? I think 85-lb. rails are laid throughout. Considering the weight on the driving-wheels of the Baldwin engine working the "Royal Blue" express, I do not think a 67-lb. rail would carry them.

3508. What is the weight on the driving-wheel of our engines—I mean the Baldwin engines? Six and a half tons on the Moguls.

3509. *Mr. Hoyle.* In any case, then, you believe that Dr. Williams was wrong in his calculation? I venture to say that he went a little further in the expression of his opinion, perhaps, than he intended to. The firm certainly threw all the responsibility on the Government by writing, "We should be gratified if, on further consideration, it is decided upon."

3510. If he recommended these engines with the weights on them they bear, considering the strength of our rails, he would be wrong? I think he would say that the engines are too heavy if he knew that we had 71-lb. rails. I suppose he did not remember the weight of the rails; it was the duty of the Government to send him a section. If they wanted a heavier engine than the rail would carry they should have sent a section and all particulars.

3511. Do you know Mr. Price Williams? I do not know him personally, but I have heard of him.

3512. He is a man of some considerable repute? Yes; some people think so.

3513. Well, I find in his report laid upon the table of the Legislative Assembly on the 13th August, 1889, that he recommends, with regard to the Great Western Railway, Granville Junction to Bathurst, as follows:—"On the down line between these two places (the Junction and Penrith) there are still about 12 miles of iron rails, which, with the exception of occasional replacements, have been on the road for periods varying from twenty-two to twenty-nine years; here and there in the 12 miles small portions of the road have been rerailed with steel rails. The whole of this mileage, however, should be entirely relaid with steel rails, resleepered, and ballasted with blue rock ballast. The few steel rails and sleepers removed being utilized for repairs." Mr. Price Williams believed that the iron rails were not right, and recommended that they should be removed. Do you consider, taking into consideration the weight of these engines, that these rails should be removed? Yes, I do; I quite agree with the report there.

3514. You say you examined the valve gear this morning, and that you think it too light? The valve buckles are certainly light.

3515. Now there have been repeated failures of the reversing gear? So I understand.

3516. I ask you as an engineer do you think these failures ought to have taken place within so short a time of the placing of engines at work? No, I do not think failures of this kind should take place in new engines.

3517. What faults did you find in them? The fulcrum pin of the main reversing lever is too light for the strain put upon it, and it has yielded. The valve buckles are also too light; neither is strong enough.

3518. Could the reversing gear be caused to fail by reason of rough usage on the part of the driver? Yes, but it would be excessively bad usage, and I do not think a driver would be guilty of anything of the kind, except in case of an accident, or if there were very great danger ahead. I do not think that with ordinary fair usage such gear as that could get out of order in such a short time. Of course, if an engine were reversed in the event of accident or anything of that kind you might expect all sorts of things to happen.

3519. Did you examine the brake gear of the engines? Yes.

3520. Did you consider the rod connected with the brake—the blocks—strong enough? No, I do not think it is strong enough considering the fact that the Westinghouse brake is applied very quickly. The joints of the rod appear to me to be too light.

3521. Suppose an engine were coming down one of our roads with a heavy load on it, and this rod broke, would it be dangerous? It might result in some trouble; being a light rod unless it got under a wheel I do not think it would cause a very serious mishap. The drivers examine these parts of the engine every day, and if anything is coming out or looks wrong they keep their special eye on it.

3522. Suppose a driver is approaching a station and the signal is against him, he would in the ordinary course turn off the track, and suppose the brake gear broke, then would it be dangerous? Yes, if the rod got under the wheels, a three-quarter rod might throw the engine off, if on a curve, but ordinarily I do not think there would be much probability of any exceptional danger arising from the rod breaking.
3523. The driver could brake his carriages even if the gear failed? Yes.
3524. You speak about bad welding in these wheels, now I want you to be particular about this point. You have said that the band of the wheel was rather light. Suppose the tire were turned down to its utmost limits would that be safe with the defects you have discovered? Well I should limit the turn down to $1\frac{1}{2}$ inch instead of $1\frac{1}{4}$ to that engine on account of the wheels being so light.
3525. You say there is a likelihood of danger arising from these wheels overlapping, galling, etc. Considering that you hold that opinion, do you think there would be any danger if the tires were turned down even to the distance you have stated? An inch and three quarter thickness of tire there would be less danger, but under that I should think it would be an unnecessary risk to run.
3526. Do you think there is any danger of the boss of the wheel bursting? Yes.
3527. That is of the leading, driving, or trailing wheel? Yes; on account of the smallness of the metal round the axle.
3528. Did you hammer the cranks? No; it is such a lump of metal I could not very well do that.
3529. You have seen the size of the crank and you consider there is metal enough above the boss of the crank? Do you think that the crank boss might burst? Yes; I think the crank boss will yield sooner or later, and also the crank pins.
3530. Would the bursting of the boss of the crank be a serious matter? Yes, it would be a very serious matter.
3531. I mean the boss of the crank? Yes.
3532. Did you make any examination of the boiler? No; I should want to see it stripped down in order to examine it inside and out.
3533. From your knowledge of, and what you could see of the boiler, did you think the pressure of 160 lb. to the square inch would be too high? I should have to measure the thickness of the plates, the diameter, and so forth. I cannot give an opinion from seeing the back of the firebox, which is all I saw.
3534. Did you consider, in connection with the bogie wheel, whether the running hot has been caused more by over-weighting on the bogie than by any laminations of the iron? It has been caused by laminations of the iron with inattention to lubrication. I do not think the bogie is overweighted, although it has got quite enough weight. It is rather heavy per wheel, and that is undesirable.
3535. Whose fault was the want of lubrication;—was it the fault of the engine or the driver? I did not look at the oil-cups on the bogie boxes, but, I suppose, there would be proper provision made for lubrication, but, if not, it is evidently want of foresight in the design.
3536. It has been admitted that new provision for lubrication must be made, and this has been put on the engines since they came here. Supplementary provision was made for lubrication? I noticed that there was some provision on the Baldwin engines for additional oil supply coming down from the side of the boiler to the coupled axles, but I did not see the same with regard to the bogies.
3537. You examined the wheels of 456? Yes; and one was off the axle.
3538. Can you assign any reason for that axle working loose;—is it usual for axles to work loose so shortly after the engines have been running? It is unusual, and the only answer is that the axle must be too small for the wheel.
3539. *Professor Warren.*] Which wheel are you referring to? The driving wheel. Axles are usually stamped with the pressure at which they are put on, but that was absent here.
3540. *Mr. Hoyle.*] What is the usual pressure? It is 10 tons to each inch of diameter usually.
3541. Did you specify for any special pressure? Yes; it is usual to do so. Eighty tons to a diameter of 8 inches—that is, 10 tons to every inch of diameter. That is the rule I observe.
3542. The Baldwin Company must then have known that the axles were not tight? The man who put the wheel on the axle must have known it.
3543. Did you consider that the reversing gear on these engines was defective in any other way than you have stated? No; I think the reversing gear fairly good now, with the alterations that have been made. A catch has been put on to keep the screw from running backwards and forwards; the new fulcrum pin has been put in. The gear is not so simple as it might have been, but that is a matter of design on the part of the maker. It might have been smaller and less expensive, but it is not bad gear.
3544. That has been done since the engines came here? Oh, yes.
3545. Seeing that screw-reversing gear was specially mentioned in the specifications, the Government should have sent drawings of what they meant by that. You think the specification is indefinite, do you not? Yes. Seeing that we had a special kind of reversing gear put on the original engines of twelve years ago, and since that we have got more experience, we seem to be going backwards. The screw put on the original Baldwin engine is the same as our standard, and I presume the drawing was sent for it, but in this instance there is a further departure. We talk of interchangeability, but this is an instance of not carrying it out.
3546. The only reason you can give of these axles running hot is that they were manufactured of imperfect iron? Yes; they were made of imperfect iron, and there was a want of attention, and I think that if the Chief Mechanical Engineer had seen the axles he would have hesitated before they were allowed to go under the engine. I know that I should have hesitated. In fact I am surprised beyond measure that they are iron axles in this day. I thought they would be Otis steel for certain, but I think it was specified "iron or steel"—what does that mean?
3547. *Professor Warren.*] Whichever way you like, I take it? Yes.
3548. *Mr. Hoyle.*] Taking into consideration the alterations made to the valve-gear and the reversing gear, and the breakage which, according to the evidence, have occurred, do you think that they ought to occur, or that alterations should have to be made so soon after the engines commenced to run? No.
3549. Have you any experience of engines failing in a similar way? No, not in a similar way; but I have known of English engines failing in a worse way. The cylinders got loose on the frames, and many other grave defects.
3550. *Professor Warren.*] I will give you the details of the cost of repairs to these very engines. The costs of all repairs have been as follows to twelve passenger engines:—

I have the honour to forward herewith information as asked for with reference to the cost of repairs of the Baldwin locomotives recently supplied.

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Mr. T. Midelton. I may say I have omitted the cost of repairs in connection with the replacements of the axles which were admittedly defective, and the cost of which was charged against the Baldwin Company, as shown in statement already put in.

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TWELVE PASSENGER ENGINES.

The cost of repairs and alterations have been as follows, and statements are attached giving details—

	Total.			Average per engine.		
	£	s.	d.	£	s.	d.
A.—Alterations	113	9	10	9	9	2
B.—Shop repairs (excluding cost of repairs through accident—£79 9s. 10d.)	375	17	4	31	6	5
C.—Running repairs	481	2	7	40	1	11

With regard to the first item I may point out that the cost was principally for small extras which the makers could not be called upon to supply, and which we, in conformity with our practice, thought it well to provide—such as fixing hand-rails in front of tenders, fixing coal board to tenders, shield plates for fire-room doors, frames for departmental notices in cabs, part cost in connection with testing axles, and for slight alterations to brake-gear and shoes.

With regard to the cost of shop repairs, the heaviest items were in connection with repairs necessitated through errors on the part of employés.

The running repairs, considering the work the engines have done (being seven months at work and running 213,861 miles) are reasonable.

3551. *Witness.*] What is the total cost per engine since they have been here?

3552. *President.*] We will add that up for you. The total cost is £970 10s.—that will make £80 17s. 6d. per engine.

3553. *Witness.*] Does that include the brass boxes on the bogie?

3554. *Professor Warren.*] Do you consider that these alterations and repairs are excessive for the time these twelve engines have been running—about seven months, I think? I think there must be a little error in the statistics.

3555. You think the cost is over or under—which? It includes the reversing gear, the new axles, the boxes—

3556. *Professor Warren.*] It includes everything except the axles.

3557. *Witness.*] How can that be a fair estimate of the cost of the engine when you except the cost of the axles. I think it is excessive. What time and how many miles per engine did they run during these six or seven months. We ought to have the running repairs, taking into consideration the work the engines have done during the seven months, together with the number of miles they have run.

3558. *Professor Warren.*] The mileage is 213,600 miles.

3559. *Witness.*] That for twelve engines is not very much.

3560. Well, I will read the letter to you again? I do not think it would alter my opinion if you did so. The data is somewhat misleading. I should want to know more before I formed an opinion as to whether the cost of repairs is excessive or not. I must know the mileage, the work, the time, the cost of running, repairs, &c.

3561. You say this report is not complete? I do not say it is wilfully wrong, but it is not such a return as I would like; it is incomplete.

3562. It is only a preliminary report? Then it is utterly worthless if it is only a preliminary report. I do not think you should be guided by it. I should like to know the mileage, the time, and the cost of each engine.

3563. *President.*] It is over 17,800 miles for each engine? Well, that is given for seven months. Are you quite sure of the figures, sir?

3564–5. *Professor Warren.*] Yes, that is right. That is equal to about twelve months work in England—twelve months work in England is from 18,000 to 20,000 miles per engine. But you do not care to answer that question? No, I certainly do not care to answer without the complete data, and I should like to scan over the data myself before I did answer it.

3566. *Professor Warren.*] It is quite useless for me to ask you any questions about the twenty goods engines, then, because the data in regard to them is no more complete than it is in regard to passenger engines.

3567. *Mr. Hoyle.*] I think you ought to have the data laid before you with regard to the repairs done to these various engines after the whole of the evidence is over, because a number of engines are now undergoing repairs. Engine No. 456 is having a new set of wheels. Engine No. 447 is undergoing repairs also. Then, too, there are engines in the Penrith shop undergoing repairs as well; and, if I might make a suggestion, I think a return should be supplied from the time-sheets, as that is the only way in which their completeness can be ensured.

3568. *Witness.*] Some of these repairs might have been unnecessary, as I have hinted, with regard to the axles. I might say that repairs, so-called, were done to my engines when they arrived here first—the Westinghouse Brake, with which they were fitted, was in the opinion of someone not sufficient, and, as a consequence, they chose to spend £50 or £60 per engine upon the addition of a hand-brake, and they have to this day allowed a similar engine (105) to run without a hand-brake.

3569. *President.*] Well, if they have spent so much more money than was necessary upon the engines, so much the worse for the Railway Commissioners; but, assuming it to have been properly spent, in other words, assuming the repairs to have been really necessary, are you now prepared to say that the amount involved in repairs was excessive? No; I cannot possibly answer the question now; I must decline to do so until I have seen the complete list of repairs.

3570. *Professor Warren.*] Mr. Midelton cannot answer the question—clearly, the return is incomplete.

3571. *Witness.*] Before I can answer the question, I must ask to be allowed to see a complete list of repairs taken from the time-sheet, the repair books, the running sheets, and the casualty book.

3572. *Mr. Hoyle.*] Perhaps the best thing would be for me to put in writing exactly what I want these return sheets to comprise.

3573. *Professor Warren.*] I have no doubt, Mr. Hoyle, that the Commissioners thought this was a complete return, but, apparently, it is not.

3574. *Mr. Hoyle.*] I think that completes the list of questions that I want to put to Mr. Midelton.

3575. *President* (to Mr. Fehon).] Have you any questions to put to Mr. Midelton.

3576. *Mr. Fehon.*] I would like to ask one or two questions, not upon the expert evidence that he has given, but upon the facts. Mr. Midelton stated he was a member of the Master Mechanics' Association—a society composed of locomotive superintendents from various parts of the world. To witness. Do you get their returns regularly, Mr. Midelton? I do.

3577. Do you know that in June, 1891, they limited the weights on driving-wheels to certain weight? I do.

3578. Do you remember what the weights were? No, I do not.

3579.

3579. You are not aware that it was decided by them that they would allow a weight of 32,000 lb. on the driving-wheels; that is, 14½ tons for rails under 60 lb. to the yard, and a weight of 36,000 lb., or 16 tons 1 cwt. for rails over that weight? I will look it up. I do not know from memory.

3580. *Mr. Brown.*] If that is so you would be guided by the judgment of such a society as that, I suppose? I should, of course, but it is commonly known that the sleepers are put rather closer together in America than in England, and it all depends upon the sleepers and how close they are put together. That is a matter for Mr. Deane, the Engineer-in-Chief for Railway Construction, and not for me. He should fix the load per wheel.

3581. *Mr. Fehon.*] As you are a member of the Master Mechanics' Association, I thought you might know something about it? The decision of weights upon the driving-wheels rests with the Permanent-way officer and not with the Locomotive officer. The Permanent-way officer is, as a rule, a gentleman who thinks he is superior to the person who designs the engines; unfortunately, the Permanent-way officers and the Locomotive officers fight like demons at times on many railways in the world. There are some exceptions, however, in which they do work in harmony of the most complete, but it is not here.

3582. I think it is here then, for we all work in harmony now? It is the first time in your life then; as a matter of fact, there is not a more disorganised and demoralised Locomotive Department under Heaven than that of New South Wales.

3583. You say that, in the ten engines which you claim to be yours, the tyre is fitted in an improved way and the proper way, and that there are no other engines in the Department that are fitted properly? That is so. I am supported by the Board of trade.

3584. That is to say that you put your opinion against that of all other makers? No, I do not; you are trying now to show me in the light you always have done. Every Locomotive Superintendent ought to know that a tyre fastened with a stud is an improper way of doing it. I wish to be very emphatic and very clearly upon this matter, because I have been working for this railway for the last twelve years to try and provide the best possible things for it, and the late Commissioner will allow that I think.

3585. You have stated that Dr. Williams must have been wrong in giving the advice he did as to the weights of engines running upon the railways of New South Wales? It is on record what I said.

3586. Are you not aware that the permanent-way of the New South Wales railways is much better than it was when Dr. Williams was here? Yes, I think it is.

3587. Therefore, if it was capable of carrying the weight of a Baltimore and Ohio engine when Dr. Williams was here, it ought to be very much more capable of carrying it now? It ought to be.

3588. Speaking of tyres, did you ever know a tyre come off an engine whilst you were on the railways of New South Wales? I never said that a tyre did come off.

3589. Well, at all events, a great deal of evidence has been given about what would happen if a tyre did come off and the advantages of providing against the calamity? It does not follow that because you never have had a tyre come off you never will have one. The Jolimont accident in Victoria is an instance of what I mean.

3590. You say that it was always specified that there should be 10 tons per inch pressure on the wheels of our engines;—did you specify that in regard to the ten engines that you ordered upon your own design? No, I did not. I ought to have done it, but considering that the Commissioners hurried me beyond measure and beyond reason to get these drawings ready, I think it is too bad to chide me for any little oversight now. When I sat down coolly and calmly to draw my designs, I did not forget anything. In 1883 I specified this for the six suburban engines built by the Vulcan Company. You carefully avoid referring to that specification, which I also wrote myself. Dub's people knew that it should have been in the specifications, and the Baldwin Company knew it too.

3591. *Professor Warren.*] You admit that it was an oversight in your specifications? I do. If I had noticed the omission I should certainly have it in, and for that matter my head draftsman might have called my attention to it, he knew my views.

3592. *Mr. Fehon.*] Did you specify the pressure on the driving-wheels in regard to the engines that were ordered from the Baldwin Company? No; considering that that specification also was written in three nights, with my own hand, in my own house, I do not think you could wonder that I did omit to include it. If you had had to do the same you would probably have made the same omission. That specification was written under great pressure to catch the mail, and, as I say, I wrote it in my own time after I had done my work at the office.

3593. You have stated that you consider that 15 tons 3 cwt. on the wheels on the Baldwin engine is too heavy for the roads of New South Wales? Yes; with the sleepers 3 feet 1 inch apart, and iron rails at that—Murrurundi to Tamworth to wit.

3594. And yet you admit that a crank engine with a weight of 16 tons 7 cwt. on the driving-wheel was alright. You allowed that to run? I did nothing of the kind. I objected to it. I protested against their being imported twice over in 1883 and in 1885.

3595. Well they did run? Yes.

3596. Did they do any damage? Yes, they did, and I pointed it out to Mr. Eddy the first day he was here. I pointed it out to him in front of the Stores at Eveleigh, and he immediately sent for Mr. Cowdery about the state of the permanent way; the joints were very low.

3597. Are you aware that those engines are running now on the main line? The 351 class do you mean?

3598. Yes? I know they are running to Liverpool and Parramatta, but you have put an 80-lb. rail down to carry them.

3599. Some evidence was given just now with regard to the boss of a wheel breaking. Did you ever know the boss of a wheel to break on this road? Yes; I have known them to break.

3600. But not on this road? No; I do not say that I have.

3601. Do you know when it happened? It was when I was serving my time.

3602. About forty years ago? You consider that honorable, I suppose. You do not get much honour in this country at all events.

3603. Well, it must have been very many years ago? It is about thirty years ago.

3604. You gave some evidence about the strength of draw-gear, although, I think, it was disallowed by the President after it had been given? Yes; I hope you will go into that; the weakest link in the draw-gear signifies the weakness of the entire train, and not the strength of the draw-gear on the engines.

3605. *President.*] But that is not what we have to inquire into. I should think that it is just what you say. That the train itself cannot be any safer than the safety guaranteed by the weakest link in its draw-gear, but that is not what we have to inquire into. It is altogether outside the Commission that has been sent to us.

3606.

Mr.
T. Midelton.
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T. Midelton.
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3606. *Mr. Fehon.*] Mr. Midelton has been called as an expert, and the chief part of his evidence has been given from the standpoint of an expert, and not with regard to actual fact. Although it is a very unpleasant thing to do, I think I shall have to ask him two or three questions as to his justification for taking the position of an expert in mechanical engineering. He has stated to the Commission what his career has been.

3607. *Mr. Brown.*] You had better ask him the question?

3608. *President.*] Yes, you had better ask him the question, and if there is any objection to it we will then say that it ought not to be put. I understand that Mr. Fehon is saying this by way of apology for having to do something which he feels unpleasant.

3609. *Witness.*] He is doing it to damn me, if he can. His motive is obvious.

3610. *Mr. Fehon (to Witness).*] You have stated to the Commission that you were in the employ of the Main Line Railway Company, in Tasmania? Yes.

3611. Were you not summarily dismissed from that road? No.

3612. *Mr. Hoyle.*] I have been called up several times in the course of my examination of witnesses for irrelevancy, and I now ask you, Mr. President, whether Mr. Fehon is in order in putting such a question as this to the witness? It has nothing to do with the Baldwin engine, and can answer no useful purpose. It is also cowardly.

3613. *President.*] You, Mr. Hoyle, have been so far, as it were, examining your own witnesses. Although you have called a great many employees of the New South Wales Railways, they have really been your witnesses. Now, you call a witness who is not employed upon the New South Wales Railways, and amongst other things his credibility is called into question. This is done for the purpose of showing, if it can be shown, that although he professes to be a very skilful expert, and a very competent engineer, and so on, still various people have at different times found fault with him. These questions are being put to him with the object of affecting his credibility as an expert, and his credibility generally. You will have the same opportunity when the Commissioners begin their case. If some witness called by them says that the Baldwin engines are perfect machines, you will have a similar opportunity of saying to him with the object of affecting his credibility, "Has not such and such a thing happened to you," or, at all events, of showing that whatever the witness may think of himself, other people do not think he is such a great expert as he believes he is.

3614. *Mr. Hoyle.*] My objection is that these questions have nothing to do with the Baldwin engine inquiry. I might have asked Mr. Thow what he did in South Australia when he was in the witness-box.

3615. *President.*] But Mr. Thow was your own witness, and you could not cross-examine him. If the Railway Commissioners call Mr. Thow you will be at perfect liberty to ask him that question. When you are cross-examining a witness you can always question his credibility—his credibility as to whether he is speaking the truth, or as to whether he knows what he is talking about.

3616. *Mr. Hoyle.*] If that is allowed I can see no end to the inquiry. I must claim, under these circumstances, to ask Mr. Midelton all that he has done in the Locomotive Department, and I therefore think that for every reason—to save the personal feeling of witnesses, as well as to keep the inquiry to the subject of the Baldwin engines—it is better that such questions should not be put.

3617. *President.*] Mr. Midelton is here as an expert, Mr. Hoyle, and he is here as your witness. You cannot therefore ask him whether he has done this and that, and the other. His skill as an expert is believed in the first instance. He says that he is a member of such and such a society, and all that is assumed until in the course of cross-examination questions are put with the object of discrediting the value of his evidence as an expert, and he is asked by Mr. Fehon whether such and such a thing has not happened to him. That is a perfectly fair question in the course of cross-examination. You in your turn will have a right to obtain from him an explanation as to why that happened to him. Personally, I am sorry that the question has to be put, but if it is pressed I do not see that I can prevent it. Supposing that a person gets into the witness-box as an expert in surgery, and he says, "I am a member of the Royal College of Surgeons; I have had thirty years practice, and this is my opinion of the case." In the course of cross-examination it is perfectly fair to attempt to prove that, although he has been all that he says he has been, he had yet made some important mistake in diagnosis, and that by reason of that mistake he had been dismissed or disgraced by some board or body charged with the duty of looking after the public health. It all goes to affect his credibility. I am very sorry that it is necessary to press this question, and I hope Mr. Fehon will take this intimation not to go any further than he thinks absolutely necessary with this line of cross-examination.

3618. *Mr. Hoyle.*] Very well, Mr. President, if this is done I shall claim my right to cross-examine in this way other witnesses who are brought forward as experts.

3619. *President.*] Very well, Mr. Hoyle, you will claim your right, I cannot help that; but I am not going to be deterred by anything you say from ruling in this matter as I think proper. I will rule upon the questions that you may wish to ask in the course of cross-examination as occasion arises. If this was Mr. Fehon's own witness I should not allow him to put that question under any circumstances, and I hope now he will not go any further than is necessary.

3620. *Witness.*] Mr. President, all I ask is this: If Mr. Fehon is going to test me, that he may do so to his heart's content, and I hope that the Press will record all that is said on both sides, and that I shall have fair play. I desire no more.

3621. *President.*] I do not suppose that Mr. Fehon would have any desire to do anything that is not fair, and if he did it will be my duty to prevent him. (To Mr. Fehon) What do you want to ask the witness?

3622. *Mr. Fehon.*] I ask whether Mr. Midelton was not summarily dismissed by the Main Line Railway Company of Tasmania, and he says no. I take his answer.

3623. *Witness.*] My answer is no. Mr. Fehon's object is obvious. I was sent out from England by a Board of Directors to do a certain thing and I did that thing, but in doing my duty in Tasmania I displeased my superior, Mr. C. H. Grant, a friend of this gentleman's (Mr. Fehon), and one who has hired him as a business man to arbitrate between the Government's contention and his own.

3624. *Mr. Fehon.*] He is speaking of a case in which I was an arbitrator.

3625. *Witness.*] Exactly. Mr. Grant and Mr. Fehon are friends, and Mr. Grant is the General Manager of the Tasmanian Main Line Railway—at least he was—but he has gone too now. Mr. Grant was general manager, and I had two years with him, and I carried out what I was sent out to do by the Board of Directors. Mr. Grant was annoyed to see me succeed, and tried to drive me out of the service. Indeed, he called me up and did what this gentleman has learned from him to do. He said go, and I went next morning; but Mr. Grant paid me £200 for his trouble, and Mr. Fehon may question me on that if he likes.

3626. *Mr. Fehon.*] No, I do not want to do that.

3627. *Witness.*] You can ask me any question you like; I am quite prepared to go any length into my career that you think fit.

3628. *Mr. Fehon.*] Mr. Midelton has stated that he had the full confidence of the old Commissioner, Mr. Goodchap. (To Witness): Is not that so? I have every reason to believe that I had; but if Mr. Goodchap listened to every little tale from other people, no doubt he would have had ample cause for displeasure.

3629. *Mr. Hoyle.*] I will call Mr. Goodchap himself.

3630. *Mr. Fehon.*] I have no wish to injure Mr. Midelton. I simply wish to explain to the Commission the value of his evidence as an expert, and I wish to ask him a question affecting his relation with Mr. Goodchap.

3631. *President.*] I can only decide as to the admissibility of the question that is really put through the Commission after you have stated what it is.

3632. *Mr. Fehon.*] But my question would be very unpleasant.

3633. *Mr. Brown.*] I think you had better put it; as you have gone so far, it leaves an unwholesome feeling behind unless you ask the question.

3634. *Mr. Fehon.*] Mr. Midelton may remember some trouble there was about some State carriages for the Governor? Yes; perfectly well.

3635. Perhaps he might remember a portion of Mr. Goodchap's minute. It is rather a long one; I will read only a portion of it:—"Mr. Midelton has shown himself to be so self-willed and incompetent in these matters that I must recommend that he be called upon to show cause why he should not be removed from the position of Locomotive Overseer. Regard for the public safety compels me to make this recommendation."

3636. *President.*] I do not know that you have any right to ask that. You have no right to get indirectly what Mr. Goodchap's views were. We have nothing to do with Mr. Goodchap's view. You can get the mere facts of whether he was disrated, found fault with, or criticised by Mr. Goodchap, but you cannot get from any minute what Mr. Goodchap's opinion about Mr. Midelton was. In order to do that it will be necessary to call Mr. Goodchap himself.

3637. *Mr. Fehon* (to Witness).] Are you aware that Mr. Goodchap recommended your removal from the service? I may say that that was in 1885, and I suffered fourteen months' suspension. Yes; and in justice to Mr. Goodchap I beg to say that he saw his error, and subsequently recommended me for the position of Locomotive Engineer three years afterwards.

3638. *Mr. Hoyle.*] These accusations are cowardly, very cowardly, and I must protest against them.

3639. *Mr. Fehon.*] I must protest against Mr. Hoyle making any such remark. I have said already that these questions are being put for the purpose of explaining to the Board, to whom Mr. Midelton may be a perfect stranger, the value of his expert evidence.

3640. *Professor Warren.*] But how does that injure his credibility as an expert? You must remember that he was taken back again.

3641. *Mr. Fehon.*] Mr. Midelton has stated that he is not aware why he had left the service of the Commissioners. Is not that so, Mr. Midelton?

3642. *Witness.*] I am aware of this: I was summoned before you, the Chief Commissioner, and Mr. Oliver; and the Chief Commissioner told me abruptly, while talking about the business of the department, that I had not shown the qualifications necessary for the reorganisation of the department, and then I was summarily dismissed.

3643. *President.*] Was that after your reappointment upon Mr. Goodchap's recommendation? Yes; about five months after.

3644. It was in Mr. Goodchap's regime that you went back again? Yes, after he had suspended me in 1885. He recommended me subsequently in 1888. Gave me the highest recommendation for the position then held by Mr. Scott (my accuser), and I then served five months under him. Previous to that I had been two and a-half years under him as Superintendent of Tramway Rolling Stock. I served under these gentlemen (the Commissioners) for five months also, and I was told without explanation that I was not any good.

3645. *Professor Warren.*] When were you suspended? In August, 1885. In 1889 I was dismissed; kicked out like a dog.

3645½. At all events, at that time you were assistant to Mr. Scott. Then you came back to the department upon Mr. Lyne's recommendation, approved of by the Executive Council, to occupy a better position, so far as salary was concerned, in connection with the Tramways than you occupied before, and Mr. Goodchap, who had formerly recommended your suspension, recommended you for the higher position. It is only fair that both sides of the case should be stated? Mr. Goodchap, like a man, saw his mistake and the error he had been led into.

3646. *Professor Warren.*] Well, he proved it by recommending you.

3647. *Mr. Hoyle.*] Did you not receive a letter from Mr. Goodchap, congratulating you upon the manner in which you had discharged your duties during Mr. Scott's absence? Yes, and the Government gave me a bonus of £100 in addition.

3648. *Mr. Hoyle.*] Mr. Price Williams has made a report upon the railways of this colony.

3649. *President.*] How can that be admitted. You cannot read Mr. Price Williams' report as evidence, unless the Railway Commissioners themselves like to admit it.

3650. *Mr. Fehon.*] We do not deny that Mr. Price Williams wrote that report.

3651. *President.*] Very well, you may read it.

3652. *Mr. Hoyle.*] The report says: "The double line between Newcastle and West Maitland, which I carefully examined, I found to be in a very defective condition, both as regards rails, sleepers, fastenings, &c., and maintenance. This portion of the line was opened in 1857 to 1858, thirty-one years since."

3653. *President.*] Do the Baldwin engines run over that portion of the line?

3654. *Mr. Hoyle.*] They have run there until recently.

3655. *President.*] Between Newcastle and East Maitland or between Newcastle and West Maitland?

3656. *Mr. Hoyle.*] The report refers to the line between Newcastle and West Maitland.

3657. *President.*] And do the Baldwin engines run over it?

3658. *Mr. Brown.*] One or two have run over it, I believe, but not with passengers.

3659. *Mr. Hoyle.*] The contention has been that engines have been employed in the service with greater weight on the driving-wheels than these Baldwin engines, and, as those engines have run over this road, I want

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want to show what the result of the greater weight upon the line has been. The report continues: "This portion of the line was opened in 1857 to 1858, thirty-one years since, and according to Mr. Cowdery's statement, showing the age of the permanent-way, there are still $11\frac{1}{2}$ miles of the original iron-rails in the road. The ironbark sleepers here or elsewhere have been its salvation; although many of them were, I observed, rather crushed, there is still a good deal of life in some of them. Having regard to the heavy character of the traffic on this line, I would advise that the whole $11\frac{1}{2}$ miles be entirely removed. I gather from Mr. Cowdery's tabular statement that there are in addition 33 miles of the Great Northern line, where the age of the iron rails varies from twenty-four to twenty-eight years, and 71 miles more from sixteen to nineteen years old; so that, altogether, there are $115\frac{1}{2}$ miles of rails on the line, whose age at present exceeds sixteen years. This mileage corresponds very closely with that between Newcastle and Murrurundi, 119 miles, which was opened to the latter place in April, 1872, just seventeen years since."

3660. *President.*] Do the Baldwin engines run over this line. If the Railway Commissioners admit the report, you have got a right to read it, but if the Baldwin engines do not run on this line, what good can it do?

3661. *Mr. Hoyle.*] It will show what has been the effect of a heavier engine than the ordinary Baldwin engine where it has been allowed to run. I have almost finished with the report. In conclusion, Mr. Price Williams says "Having regard to these facts I consider that the immediate renewal of the 5 miles of this permanent rail between Newcastle and West Maitland, $2\frac{1}{2}$ miles between Branxton and Blandford, and 1 mile between Blandford and Werns, laid down in 1872, is the least that should be done with the view to restoring the permanent-way on these portions of the main line as quickly as possible to a sound condition."

3662. *Mr. Fehon.*] The Baldwin engines were not in existence when Mr. Price Williams wrote that report.

3663. *Mr. Hoyle.*] I am speaking of the Tank engines as referred to by Mr. Midelton just now as carrying over 16 tons on their driving-wheels.

3664. *Witness.*] And the Vulcan engines too.

3665. *President.*] Of course the report will be put in. We know the conditions under which it was made.

3666. *Professor Warren* (to Mr. Fehon).] Do you want to ask Mr. Midelton any further questions.

3667. *Mr. Fehon.*] No, I do not.

3668. *Mr. Brown.*] There has been such a lot said in the newspapers and elsewhere about the putty that was found in the spokes of the wheels of the new Baldwin engines that I should like you to refer to it in your evidence? I do not think that anything can be made of the fact that there is a little putty in the wheels, it is what anybody would do to make a smooth surface for painting.

3669. *President.*] And your contention is really this. You say as an expert that in your opinion the engines are too heavy for the roads? I do, and yet not heavy enough for their cylinders.

3670. But if the road were suitable for the engines you would not say that much was wrong with them? Certainly.

3671. What you say, boiled down, if I may use the expression, comes to this: granted that the road is good enough, the engines themselves are all right? Well, in answer to that I beg to state that a great deal has been made in the Press and by the Commissioners and Premier of the Colony about the interchangeability of the various parts of engines, and the necessity for uniformity, amongst the engines instead of the large number of types of engines such as we have at present. That is what I have been striving to bring about for the last twelve years and yet since the Commissioners came into office they have actually increased the number of types by the addition of these Baldwin engines and others from 42 to 49.

3672. *President.*] We have nothing to do with that. If in your opinion the permanent-way were strong enough you would not have much objection to the engines? If there were 80-lb. rails throughout the Colony I should say that we do not want Baldwin engines of that weight; we want Baldwin engines of a lighter weight.

3673. *President.*] But come to my question. Suppose the permanent-way were strong enough, what do you think about the engines. Do you see anything wrong with them? No, I cannot say that I do; but they are not the type of engine that I should prefer.

3674. *President.*] No, exactly; but I understand you to say that you do not see anything wrong with them.

Joshua Rushworth, being sworn in and examined, said:—

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3675. I have been over thirty years a ganger on the railway line.

3676. *President.*] In this Colony? Yes; at least, it is over thirty years since I started first, and about six years since I left that particular work.

3677. Then you are not now in the Railway service? Not now.

3678. Were you a ganger all that time? Yes, for the biggest part of it.

3679. *Mr. Hoyle.*] You were a ganger on the line for about thirty years? Yes.

3680. In the service of the New South Wales Government? Yes; but not a ganger all that time; I mean that it is about thirty years since I came here first. My first work here was to relay a piece of road on the Duck River line.

3681. Were you at Tarana when the recent railway accident occurred? I was.

3682. Were you on the scene of the accident soon afterwards? Yes, about three-quarters of an hour afterwards.

3683. Did you see the rails that were broken? Yes.

3684. Did you see any other bent rails? I saw one bent in that position (bending his arm); it was about 1 foot in the belly from being straight.

3685. Was that in the road;—did it form part of the permanent-way? Yes; it formed a part of the permanent-way.

3686. You have had a lot of experience in lifting roads, have you not? Yes, I have.

3687. Have you examined the road between Tarana and the scene of the accident? Not since the accident occurred.

3688. Have you ever been on that part of the road? Yes.

3689. When was that? About twelve months since I was along the road, and also a week before the accident happened. On that occasion I was out shooting, and walked along a portion of the line down as far as the creek.

3690. Would you know from the appearance of the road whether it had been recently lifted? Yes.

3691. Do you think it had been recently lifted? If it had not been recently lifted it had been recently ballasted.

3692. Can you say what state the road is in about there at the present time? Well, from what I saw of it, I should not say it was in a very good state of repair. The sleepers still keep shifting out of their regular place; they vary a very great deal; some of them are very little more than 11 inches from the joints, and others are nearly 2 feet from the joints. They naturally work loose, and if they are not put back again the bearings of the road will not keep equal. Instead of all the sleepers being 2 feet 9 inches apart, there are some sleepers over 3 feet apart.

3693. You mean that the chairs upon which the sleepers are fixed are in some cases 3 feet apart? Yes.

3694. Did you see on that road in any part of it that the rails had been crushed? Oh, there are a good many rails crushed.

3695. *President.*] Is a crushed rail the same thing as a spread rail? Yes; it means spread out on either side.

3696. *Mr. Hoyle.*] In examining the road, did you see any rails that had been turned,—did you see any rails that had been worn by running on one side, and then turned and run upon the other side? Yes; a good many.

3697. Did any of them show evidence that they had been bulged? Some of them had been bulged before they were turned.

3698. That is to say, the bulged side is now down? There is a bulged side uppermost and also a bulged side down.

3699. From your experience as a ganger, would you consider that that weakened the rails? Yes; it does.

3700. From what you know of an iron rail, and the action of cold weather upon it, do you consider it safe for a Baldwin engine to run over the road in its present condition? No, I do not; nor for any heavy engine to run over it either.

3701. *President.*] What do you call a heavy engine? An engine of 60 or 70 tons.

3702. Is it not safe for an engine of 60 tons to run over that portion of the line? No; I do not think it is safe.

3703. *Mr. Hoyle.*] Were any of the sleepers bad? Yes, there are plenty of places where I could go and lift the rail—places where the spikes would draw out of the wood and leave the sleepers below. The chairs have worked that much with the oscillation of the engines that you could lift the spikes out.

3704. *Professor Warren.*] You are alluding to the spikes that are in the chair, I suppose? Yes, to keep the rail firm.

3705. If the key was in the rail, could you then lift it? The chair would come up with the rail, but the sleeper would be left in the ballast because of the spikes having no hold.

3706. *Mr. Hoyle.*] Did you find any other defects in the road, such as keys being out, and so on? Oh, there are keys out. The Sunday before the accident I walked down to the quarries, and saw a good many keys out, but it is not an unusual thing to find that. The ballast is the greatest thing for keeping the keys in.

3707. Then if the road were well ballasted the sleepers ought to stop in their places? Well, if even the key was in, the sleeper would naturally work.

3708. Do you know what length there is for each gang to look after? I think it is about 6½ miles.

3709. And how many men are there on that gang? About five.

3710. Do you consider that, with these heavy Baldwin engines going over the road as they do, it is enough to have five men and a ganger in order to keep it in repair?

3711. *Mr. Brown.*] Is that not a question of administration?

3712. *President.*] I was going to say before Mr. Brown spoke that, if the road is not properly looked after, that would be a matter of negligence—I do not say that it is not properly looked after—I know nothing at all about that;—but even supposing you proved that it was not properly looked after, and in that respect the Railway Commissioners were guilty of negligence, how would it prove that the engines were not suited to the permanent-way of the country, because the engines are supposed to be suitable for the permanent-way, provided that it is kept in order. If you say that the permanent-way is kept in order, and still that the engines are too heavy for it, and would crush it by reason of their weight, that is to the point clearly enough; but how can you show that by calling evidence to demonstrate that a certain length of line has been neglected?

3713. *Mr. Hoyle.*] I am not calling this evidence with any intention of showing neglect on the part of the Commissioners. I am merely calling it for the purpose of showing that this line is not fit for these heavy engines to run over.

3714. *President.*] But it would not be fit for any engine to run over if it is in the condition that has been described by the witness. I imagine that a permanent-way requires hourly, or very nearly hourly, attention; and if the necessary attention has not been given to it, and as a consequence the permanent-way has got into disrepair and would be dangerous for the Baldwin engines to run upon, you cannot say that therefore the Baldwin engines are unsuitable for the permanent-way of the Colony.

3715. *Mr. Hoyle (to Witness).*] Do you know the weight of the Baldwin engines? No.

3716. Well, the Baldwin passenger engine weighs 92 tons, and the Baldwin consolidation engine and tender weigh 97 tons;—do you think that an engine and tender of that weight would have a tendency to knock the road about? Certainly, particularly in a bend coming out of a straight on to a curve, because in going on to a curve the engine always strikes the rail heavily, and the heavier the engine the more strain there is on the rail.

3717. Do you think then that these heavy engines continually passing over the road have injured it, and caused these sleepers to work? Undoubtedly, to a certain extent. Of course, a heavy engine will cause it to happen more than a light engine would, and the longer it runs on it the more liable the sleepers will be to shift, particularly at the beginning or end of a curve. The oscillation in the case of the Baldwin engines is greater than it would be in the case of lighter engines.

3718. *Professor Warren.*] That is from your own observation? Yes.

3719. You say that the oscillation is greater? Yes; you can see it is greater on entering a curve than on a straight.

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- Mr. J. Rushworth. 3720. Do you say that the Baldwin engines oscillate more than any other engines? I do not say that they oscillate more, but I say that the weight of the oscillation is greater.
- 4 May, 1892. 3721. *President.*] Of course, we all know that if two things oscillate the heavier one will do the more damage, if damage is done by oscillation. I suppose that is what he means.
3722. *Professor Warren.*] He said that the Baldwin engines oscillated more than other engines.
3723. *Witness.*] No; only I say that being heavier it is harder for the oscillation to stop.
3724. *Mr. Hoyle* (to *Witness*).] Have you worked much about the mountains in your time? No, I have not.
3725. In your experience on the railway has it been anything like a common occurrence for rails to break? Oh, it is a common occurrence for rails to break. I have known the old Barlow rail to break, and it is one of the toughest rails that was ever made. It is a hollow rail. They were the first rails laid between Parramatta and Sydney.
3726. Do you know any other part of the road near Tarana—I mean towards Bathurst? No, I have never been working at it, though I have walked over different parts of it.
3727. But did you examine the road recently? Well, of course a man who has been so long on the line cannot shut his eyes as he walks along. If he sees a defect he must notice it.
3728. And from your experience would you say from walking along the road that there are many defects in it? Yes, a great many.
3729. Can you describe to the Commission what they are?
3730. *President.*] Pardon me, Mr. Hoyle; I do not wish to interrupt you unnecessarily, but I hardly see what all this is leading to. If it helps your case, then by all means bring out the evidence that you are endeavouring to get at; but do not pursue it unnecessarily, for it is a matter that must necessarily be inquired into presently, because I suppose there are sure to be some actions arising out of this accident, and it is not right that the question should be prejudged in any way. Personally, I do not see how it can help us in arriving at our decision. Supposing, for the sake of argument, a part of the road had been left unattended to, that would not show that the engines were not suitable to the permanent-way. It will only help us if you can show that the road, being in a fair state of repair, it has been crushed and spread by the Baldwin engines.
3731. *Mr. Hoyle.*] Well, I want to show that the Baldwin engines are knocking the road about. I have been told that the road has been relifted within the last four months, and, if that is so, it ought to be in good condition now. I contend that if the road has got out of repair within so short a time it is the Baldwin engines that are doing the damage.
3732. *President.*] Very well.
3733. *Mr. Hoyle* (to *Witness*).] Will you describe to the Commission in what condition you saw the road between Bathurst and Tarana? Well, that portion of the road has been running a long time without being relifted, and, of course, when a road has been running a long time it gets bad; the rails spread and the sleepers work, but I do not say that it is in a dangerous condition.
3734. *Mr. Brown.*] You would say it was safe enough for ordinary traffic? Yes.
3735. *Mr. Hoyle.*] If the road was lifted within four months and rebalasted, as it evidently has been, do you consider that the ordinary traffic—such traffic as it had been subjected to before the Baldwin engines arrived—would have left it in a better state of repair than it is at present? With the ordinary traffic it is my opinion that the road would have been in a better state of repair.
3736. *Professor Warren.*] And you think that the Baldwin engines have knocked the road out of line? Yes, particularly going on to the curve.
3737. Entering a curve and leaving a curve? Yes.
3738. *Mr. Brown.*] I suppose you have turned a bulged rail yourself when you have been fettling? I have.
3739. It is not an uncommon thing to do when you are short of rails, is it? Well, when a rail is bulged out one side you turn it to the other side.
3740. *Professor Warren.*] Do you mean when a rail is bulged on the face? Yes, on the face.
3741. Will you show us upon these rails exactly what you mean? (*Witness* proceeded to explain by the aid of some rails brought from the scene of the late accident the purport of his answer.)
3742. *Mr. Brown.*] To Mr. Fehon: Have you had that flaw in the rails microscopically examined?
3743. *Mr. Fehon.*] No, we have not.
3744. I would have as careful an examination of it as you can, and bring as much expert evidence before us as you can.
3745. The Commissioners have appointed a Board of experts to investigate the matter.
3746. That is all very well, but that will not help us to arrive at our decision, we want as much expert evidence as you can bring.
3747. *Mr. Hoyle* (to *Witness*).] This is the rail that broke when the train was going over it, can you tell us whether that is a turned rail? Yes, it is; evidently this rail had been worn out on one side and turned.
3748. You have seen these two rails, and I will not ask you to swear, but will only ask you to give your opinion upon this matter, because at the time of an accident like the recent accident at Tarana, a man may be a little bit excited, but do you think there was any bent rail besides these two? Yes, I am sure there was.
3749. And it was after the accident occurred that you saw it? Yes, by the appearance of the rail I should say that after the carriages got off the line they bent it.
3750. *Mr. Brown.*] I do not quite follow you? Supposing the carriages got off the line here, they bent a second rail there?
3751. *Mr. Hoyle.*] There is a rail that was bent in the accident that has not been produced here at all.
3752. *Mr. Fehon.*] Very often there will be a dozen rails bent in an accident? Oh yes, it is quite a common occurrence if a train gets off the road that it will smash the chairs and bend the rails one after another.
3753. Do you consider that the road as you have seen it has the sleepers the proper distance apart? Not for those engines; the sleepers are too far apart for those engines.
3754. What distance apart do you think they ought to be? For those engines they ought to be more than —
3755. I want to ask you first of all how far ought the sleepers to be apart on a curve, and then I want you to tell me how far they ought to be apart on a straight? They ought not to be more than 2 ft. 4 in. apart on a curve.
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3756. From centre to centre you mean? Yes; and about 2 ft. 10 in. apart on a straight.
3757. *Mr. Brown.*] And what are these sleepers in the immediate vicinity of where this accident took place. Have you any evidence on that point? Well some of them are over 3 ft. apart.
3758. That is from centre to centre? Yes.
3759. *Mr. Hoyle.*] I measured some myself that were 2 ft. 3 in. apart, others that were 2 ft. 8 in., and so on. They were different distances.
3760. *Professor Warren.*] You might give evidence yourself on that point, Mr. Hoyle.
3761. *Mr. Brown* (to Witness).] What are the gangers doing not to put them back in their places. That is what they do when they go along the line? They put them to their uniform distances, and often they shift them to a uniform distance when lifting the road.
3762. *Mr. Hoyle.*] How much ballast is there from the sleepers to the foundation? I never sank down to see, but if it is on a level from the grip to the curbstone the ballast must be somewhere about 2 ft. deep.
3763. You have not measured it, however, and do not know how much there is? No.
3764. *Professor Warren.*] From your experience as a ganger, you say that the road is knocked about by the Baldwin engines more than by other engines? That is my opinion.
3765. I take it that you have seen the Baldwin engines running on the permanent way? I have seen the Baldwin engines running and I have seen the others running, and my experience is that the Baldwin engines knock the road about more than the light engines do.
3766. Have you been on the Tarana section very long? No; I was only there for a week or a fortnight on a shooting excursion. I was up there enjoying my holidays.
3767. I only ask you the question because you have seen the other engines go over the line, and you know what you have to do to the permanent way by way of driving in keys and seeing that everything is right? Yes.
3768. And you say that the Baldwin engines damage the permanent way more than the old engines? Yes.
3769. *Mr. Brown.*] In bending a rail for the purpose of a curve, is it likely to crack it or make a flaw in it, or do anything else to damage the rail? I have seen rails break in two when we have been making a curve.
3770. And is that more likely to occur in old rails than in new ones? It depends on the material on the rail. An old rail will often curve better than a new one.
3771. And not be likely to give signs of breaking? If, when you were curving a rail with a hammer, there was the least flaw in it, you would find it out under the hammer.
3772. But would that flaw be liable to disclose itself after you had finished with it and trains had been running over it for a while? No; if it was injured at all, it would show when we were hammering it.
3773. *Mr. Brown* (to *Mr. Fehon.*)] Would you like to ask the witness any question?
3774. *Mr. Fehon.*] I would like to ask a few questions. (To Witness): Are you now in the employ of the Railway Commissioners? No, sir.
3775. When did you leave? Six years last Easter?
3776. And what do you know about the Baldwin engines, seeing that they have been here only a few months? Well, I have seen them running.
3777. However, you know nothing about them practically. You have not worked on the road since they have been here? No, I have not, but I have seven or eight years' experience on the line at home before I came to this country, and if I am standing on the road whilst the engine is passing, I know how it is knocking the road about. I have got experience enough for that.
3778. Speaking about the crushed end of rails, as you have had experience at home as well as in the colonies, you can tell whether it is a common thing or an uncommon thing for the end of rails to be crushed? It is a very common thing.
3779. You spoke about the weight of the engines being too great for the permanent way—do you know how the weight of an engine is calculated in relation to the strength of the permanent way? The weight on the wheel.
3780. Yes? I do not know.
3781. But you know that it is calculated on the wheels? Yes.
3782. Do you know the heaviest weight on the wheels of the Baldwin engine? No.
3783. Well, how can you say that those engines are too heavy for the road? It is not the down weight that tells so much as the oscillation.
3784. Then you think the down weight is all right? No, I do not.
3785. But if you do not know the weight how can you say that it is too great? Because the oscillation is so great it is liable to move the road.
3786. I am not speaking about the moving of the road. What is your opinion as to the strength of the road to bear the weight on the driving-wheel. But as a matter of fact you say you do not know the weight on the driving-wheels, and therefore perhaps it is hardly worth while asking you a question on the subject. You say that it is the ballast that holds the keys in? Yes, very largely.
3787. How do you make that out? Because most of the keys are made in the colony, and are not down long before you can shift them about with your hands.
3788. Where does the ballast cover the keys? In many places.
3789. As a matter of fact, are not the keys exposed to sight? Very often they are.
3790. *Mr. Brown.*] Is not a man engaged every morning in hitting them with a hammer, to see they are all right? Yes.
3791. And if they are covered with ballast how can he do that? He can see the heads.
3792. *Mr. Fehon.*] Which would do the least harm to the permanent way—two lighter engines coupled on to a train or one heavier engine? One heavy one.
3793. You do not know anything about the Baldwin engines as to the way they are made to suit the permanent way of the Colony? The only thing that I know about them is from looking at them; the frame is all built in one piece, there is no give in them.
3794. You say that the sleepers are not sufficiently close together on the curves? No.
3795. What is the rule about sleepering a curve? Well, on a curve they put eight sleepers under a 21-foot rail, and nine if it is a curve of 8 chains radius.
3796. What do they do if it is a straight road? They put seven sleepers then.
3797. Suppose it is anything under a 15-chain curve do they not put two extra sleepers? No.
3798. At all events you say that you put in two extra sleepers in an 8-chain curve? Yes.
3799. And what distance does that bring them? About 2 feet 9 inches apart.

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3800. *Mr. Hoyle.*] We understood you to say that it was the sleeper being well packed—kept rigid—that kept the keys in? Yes; that is it.
3801. May I ask that the section of the rail and plan of Liberty's Creek Bridge and Duck's Creek Bridge may be produced.
3802. *Professor Warren.*] On that subject I take it that Mr. Foxlee will give evidence from the returns that he gave me. I have a number of questions to ask him, and possibly it may be necessary to ask him for plans and designs of other bridges. As an evidence of the interest taken in this matter from outside, I may say that I had a letter from a member of the Bridges Commission to-day—a man in a high position—who knew that I was aware of certain things that he was also aware of, and who thought it very necessary that I should look into these matters. It may be necessary for me to call for these plans and designs, and if it is, I shall do so, but I shall not do anything in that way that does not appear necessary.
3803. *Mr. Hoyle.*] Do you think it would be a good thing for us to have any of the plans of the bridges?
- 3803½. *Professor Warren.*] I shall wait until after Mr. Foxlee's examination before I make up my mind. Necessarily, anything that I can do must be done superficially; it would take too long to go into these matters fully. All I care about is whether the bridges are strong enough, and Mr. Foxlee's calculations so far, I may say, show that they are strong enough.

THURSDAY, 5 MAY, 1892.

[The Commission met in the Board-room, Colonial Secretary's Office, at 2:30 o'clock.]

Present:—

F. E. ROGERS, Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

ALEXANDER BROWN, Esq., M.L.C., J.P.

Henry Joseph Moses, being sworn, said:—

- Mr. H. J. Moses.
5 May, 1892.
3804. I am an engine-driver in the New South Wales Railway Service; I was driver of the western mail-train that left Sydney last Tuesday week. There was an accident to that train at a place on the line two miles and a-half this side of Tarana.
3805. *Mr. Hoyle.*] Previous to the examination of the witness, I wish to take this opportunity—and in doing so, I think I may speak, not only for myself, but for the public—to congratulate Driver Moses on the splendid manner in which he carried out his duties on the night of the accident. The forethought, care, and discretion he exercised, and the meritorious conduct he displayed on that occasion deserve for him not only the gratitude of the people of Sydney, but of the Colony generally, and I think it is only fair to state here what is the general feeling with regard to Driver Moses' conduct on that occasion. I have heard a great number of people speak about it, and I not only congratulate Driver Moses myself upon the splendid service he has rendered, but also on behalf of many others who have expressed to me their appreciation of them.
3806. *Mr. Fehon.*] The Railway Commissioners perfectly recognise all that Mr. Hoyle has said, and have recognised the services of Driver Moses in a substantial manner.
3807. *President* (to Witness).] I am sure it must be very gratifying for you to hear what has been said.
3808. *Mr. Hoyle.*] How long have you been driving the Baldwin engine? I have been driving these engines for three months. The number of mine is 452. That is the engine I have been driving since the 31st January of this year.
3809. Have you driven any others? Yesterday I had No. 457 for one trip. That is the only other engine I have been driving except No. 452.
3810. Did you find many defects in these engines during the time you were driving them either in the reversing-gear or the brake-gear? No, sir; I can only speak for my own engine, that is the one I am driving now, and she is just the same as when she came out of the shop.
3811. Have you had no repairs to the brake-valve or reversing-gear? No, she is just the same now as when she came out of the shop.
3812. Has she had many repairs made to her in other ways than those I have mentioned? No, only those you would expect from an ordinary locomotive, that is to say, the ordinary running repairs. The second trip that I ran her I noticed on the tender that one pair of the wheels, the trailing bogie wheels, on the leading end, were wrong. One of the wheels had shifted. I reported it to the Locomotive-Inspector at Bathurst. This pair was taken out and another pair substituted, and, so far as I know, three pairs of the original wheels are still under the engine.
- 3812½. Those taken out were replaced, you say? Yes.
3813. That, then, has been the only defect you know of in that particular engine? Yes, sir. The wheel worked loose on the axle.
3814. Have you ever minutely examined the wheels on these engines? Yes; on my own engine. I have not examined the others.
3815. Did you find any cracks on the spokes? No, I did not.
3816. You were driving the engine on the night of the accident. When the engine is going round a curve there is always a bumping motion is there not? Yes.
3817. When you were passing over the rail at the time of the accident, did you feel anything beyond the ordinary motion of the engine? No, nothing at all. I felt a shock at the end of the train, and I said to my mate, "It is an air pipe burst," and I put the brake on the train.
3818. You know the weight of these engines is about 92 tons, do you think that the engines being this weight have a bad effect upon the road? No, sir, I do not.
3819. What causes you to come to that conclusion? Well, for the simple reason that they are so constructed that they take the curves more easily than other kinds of engines. I had the misfortune to report the road several times on account of it having been cut about, and I was told the other day that the Yankee engines did not knock the roads about so much as the others do. They take the curves more easily. They do not jump into the curve but take it gradually.
3820. *President.*] When you reported about the road being knocked about, what engines were running then? The Scotch engines, sir. It is our duty if we find a bad place on the road to report it. I referred to the Scotch Yankees. These were on the mail service previous to our getting the Baldwins.

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3821. And you say that they knock the road about more than the others? Yes; because they jump into the curve instead of taking it gradually.

3822. *Mr. Hoyle.*] How do you account for that? I don't know how it is.

3823. Do you know that the weight on the driving-wheel is greater on the Baldwin engines than on the Scotch Yankees? Yes; I am told that it is greater, but I do not know whether that is a fact or not. I am told so. I do not know what weight the Scotch Yankee is on the driving-wheel.

3824. It seems you have driven the Vulcan? Yes; I was the first man to take a Vulcan over the Mountains. They are very rough and heavy on the roads.

3825. What is their weight? About 75 tons altogether.

3826. Well, your evidence at Bathurst, where you state that it is 85 tons, is incorrect? Yes; I have written to the Coroner correcting that statement.

3827. *President.*] Pointing out to him that you had made a mistake in saying 85 tons? Yes.

3828. *Mr. Hoyle.*] You say that that engine, the Vulcan, with a weight of 14 tons 7 cwt. on the drivers, would do more damage to the road than an engine like the Baldwin, with 15 tons 9 cwt. on its driving-wheel?

3829. *President.*] What he says is that the Vulcan engine, for some reason which he does not explain, is very heavy on the roads. *Witness.*—From the construction of the engine, I think it does more damage to the road than the Baldwin; that is what I say.

3830. *Mr. Hoyle.*] Don't you believe that the weight of an engine has something to do with the knocking about of the road—on account of the oscillation, for example? It is the way they take the curve; they jump into the curves—that is, the Scotch engines do, but the Baldwin engines take it gradually.

3831. But there is oscillation on the straight run, and it is greater there than on the curves? Yes.

3832. Then the additional weight of an engine about 20 tons heavier than the Vulcan would have a worse effect upon the road running upon the straight than the Vulcan, is not that so? Well, I have given you my experience so far as I have been a driver on the New South Wales railways; and I have also had it confirmed by what the permanent-way inspectors have said.

3833. Do you know what was the weight of the train behind you at the time of the accident? At the time the accident happened it was about 132 tons; before it happened I had an exceptionally heavy load from the Mount to Wallerawang, but the engine had no difficulty in taking this load over the heaviest grade of the mountain, the 1 in 33.

3834. What was the heaviest load between Katoomba and Wallerawang? I do not know; I did not make it up. The officer whose duty it is would know that.

3835. How many carriages had you? I had carriages equal to twenty-two and a half vehicles.

3836. Is it not a down grade? No, sir; there is some pulling.

3837. What is the heaviest grade? 1 in 33; what we call the Gins, between Bell and Clarence.

3838. How long is the hill? I could not say.

3839. About 5 miles or 3 miles? No.

3840. What would you imagine it to be? About a mile, at 1 in 33.

3841. And you had equal to twenty-two and a half vehicles? Yes.

3842. Was the train crowded? Yes, it was; there was only just sitting room.

3843. Have you ever taken the train from Penrith to Bathurst with one of the Baldwin passenger-engines? Yes.

3844. Have you had any assistance to take you up the bank? Yes, on one trip.

3845. Why was that? Because I did not know the stated load for these engines. A notice had been issued specifying the loads that were to be taken, and I did not know what it was. It was given out at the time, and, in my estimation, it was safer to take a pilot with me, than risk taking too heavy a load. As a matter of fact, I found that the load was a little short of what I might have taken.

3846. Do you think it safe to take a load of 225 tons up that grade with the draw-gear at present used? I think it is quite safe for that road with the strongest draw-gear. I think it is quite safe, and I don't think there is any reason to question it.

3847. With a train equal to 22½ vehicles, had you to shift your train to suit the platforms often? No.

3848. In your evidence at Bathurst inquest you say you were fifteen minutes late at Bathurst—you said, "I am not allowed to make up time." Why are you not allowed to make up time? An order was recently issued by the Chief Mechanical Engineer with regard to this making-up of time. He forbade drivers to make up time, especially on a falling grade, and it behoves every driver to obey this order; or, if he does not, he must bear the consequences of not doing so.

3849. Does this order apply to other engines as well as the Baldwin? Yes, I take it to do so.

3850. Did you receive a printed order to that effect—an order such as is usually given to drivers? Yes, and I signed it.

3851. Do you know whether it applied to the Baldwin engines only? I do not know whether it applied to the Baldwin engines only, but I know it said the Baldwin engines.

3852. As a driver, having your experience and care, do you think it would be dangerous to drive an engine over a road such as that between Sodwalls and Locksley, with about six miles of iron rails, at a higher rate than 25 miles an hour? Yes, certainly; because on parts of the road we have to reduce our speed—that is, where the road is in bad order. The outdoor inspector issues weekly notices, and we receive them and sign them, and they specify the speed at which we have to travel at certain portions of the road that are in bad order. We have to obey these orders, and we reduce our speed accordingly. We do not care what class of engine we are driving, we have to follow instructions all the same.

3853. Can you tell us at what particular parts you have to slow down in consequence of the roads being in bad order? Between Bathurst and Tarana to the 121 mile post, going round the Slip.

3854. Where is that? On the Bathurst side of Tarana.

3855. What speed do you slow down to? Twenty miles an hour.

3856. Do you then, in passing over that particular part of the road with your engine, find any extra motion with it? No; and we often wonder why the out-door superintendents keep these orders out so long.

3857. You have the regular gangs on the road? Yes, sir, on the regular length; and if we find anything wrong with the road we report it at the first station we come to.

3858. In what way was the train running when it struck, and the accident happened? (Here the witness viewed the iron rail, which had been placed by the Railway Commissioners in the Board-room for inspection, and pointed out what he believed to be the end of the rail that had pointed towards Sydney.)

3859.

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3859. *Mr. Brown.*] Do you know certainly that that is the end—do not say it if you are not certain? Well, I do not know certainly. I did not examine the place myself. I can say which surface it is, but I cannot say exactly which end it is.

3860. [*The Railway Commissioner present and several others examined the rail.*]

3861. *Mr. Fehon.*] There is a question as to whether the witness is not in error as to which end it is.

3862. *Mr. Hoyle.*] Is it your opinion, Mr. Moses, that your engine did not break the rail? Yes.

3863. It is your opinion, you say, that your engine did not break the rail? Yes; not in the manner it is broken.

3864. Do you think that in passing your engine had anything to do with the break? I cannot say. I think that if it had gone towards the breaking it a little, it is likely that I should have felt it.

3865. Taking the closeness of your engine-wheels and the wheels of the carriages following and the speed you were going at, it would not take you long to skim over 25 yards;—taking that into consideration, do you think the bogie could cause the breaking of the rail? I do not believe the tender would have gone over, because it was heavily laden, and there is a long space between the engine and the leading wheel of the tender.

3866. But is it not possible that it might have broken it, and since you got over so quickly you might not have noticed it? I believe the first to strike was the back carriage—I mean to strike the end of the sleeper.

3867. But you do not know? I do not know whatever.

3868. *Mr. Fehon.*] I would ask you, Mr. President, is not this making the inquiry an inquiry into the Tarana accident.

3869. *President.*] The point which Mr. Hoyle wants to make is that the Baldwin engine on account of its weight broke the rail, so I understand.

3870. *Mr. Hoyle.*] I think, Mr. Moses, that the line near Locksley has been relaid. Did not you find a great difference in your engine passing over that road and the part I am now speaking of? Yes; for there new rails and new ironbark sleepers have been put down. There are about 11 miles of that road that have been relaid, resleepered, and reballasted. Part of that line has been relifted, and that has been the case for the past four months.

3871. You have the order about the speed,—can you let us have it? Yes; but I think you can get one in Sydney. Every one has received it up the line as far as Bourke, on the Northern line, and on the Southern line as well.

3872. Do you not know, as a driver, that the weight upon the driving-wheel has a most severe effect upon the road? Yes.

3873. Then, if the weight on the driving-wheel of the Baldwin engines is greater than the weight on the driving-wheel of any other engine you have driven, do you still believe that the Baldwin engine is less injurious than an engine with a lesser weight on the driving-wheel? Yes; I do.

3874. *Professor Warren.*] Will you explain that? The reason is because the weight is more evenly distributed.

3875. So that it does not matter what the total weight may be so long as it is distributed evenly? Yes; distributed as it is upon the Baldwin.

3876. So that you might have 50 tons on the wheels, and so long as that weight was perfectly distributed over the wheels it would not matter—no harm would be done? The wheels of the Baldwin engines are closer together and the weight is evenly distributed, and they take the curve more easily than the others do.

3877. Suppose this [*drawing a diagram*] is the sleeper, and you get a weight of, say, 15 tons 9 cwt., and this line represents the rail, would not that be more likely to break it than a weight of 12 tons? Well, that depends upon circumstances.

3878. Suppose the circumstances are equal in both cases? There may be oscillation.

3879. Supposing they are the same in that respect also, would not the greater weight tend to break the rail more than the less weight would? Yes, under those circumstances.

3880. Well, if that is so, why did you say that the weight of the Baldwin engine would not tend to break the rail because the weight was evenly distributed;—does it not, as a matter of fact, depend upon the greatest weight upon the driving-wheel? Yes, to a great extent; and also the way in which your springs are balanced.

3881. Do the Baldwin engines oscillate less than other engines or more? The one I am driving I can safely say oscillates very little.

3882. Less than, say, the Scotch Yankees? Yes, sir, it does.

3883. I believe that I am right in stating that the Midelton engine is 12 tons on the pair of driving-wheels.

3884. *Mr. Fehon.*] Fifteen tons 1 cwt., I think.

3885. *Mr. Midelton.*] Thirteen tons on the pair of driving-wheels, that is it.

3886. *Witness.*] I know that they oscillated very much.

3887. *Professor Warren.*] Take the 30½ class? I have driven both what Mr. Midelton calls his own, the 30½ class, the Scotch Yankee, and the Baldwin.

3888. Which of these oscillates the most? The 30½.

3889. And which next? The Scotch. Both of these oscillate more than the Baldwin.

3890. Is it not a mistake to say that because one engine oscillates more than another it tells more upon the road. Does it not depend upon the weight of the driving-wheel as well as upon the oscillation. You do not know, you have not measured it? I judge by the way it takes the curves, and the way the men have to hang on—I mean the firemen.

3891. You have made a statement that the Baldwin engines are not so destructive on the roads as the other engines. Now, what I want to get at is this, how do you know;—do you arrive at that conclusion only because you have measured it from appearance? Yes; it is my own experience.

3892. You would not swear it? It is my impression.

3893. *Mr. Hoyle.*] The reason you believe the Baldwin is less destructive is because the wheels are closer together,—at least you give that as one reason? Yes.

3894. Do you know that the rigid base of the Vulcan driving-wheel is 8 ft. 3 in., and the rigid base of the Baldwin driving-wheel is 8 ft. 6 in.? I do not know. I only know that I took the Vulcan over the mountains, and found it very rough.

3895. Do you know what the weight of the Baldwin wheel is? No.

3896.

3896. On the Mogul? No.

3897. On the Vulcau? No.

3898. Then if you do not know the weight on the driving-wheel how can you tell the effect on the road, it is only a matter of what you think? It is how they take it. The Baldwin engine would take the curve very easily.

3899. I was not speaking of the curve? I only say the Baldwin will take it easily, but the Vulcan and Yankee will jump into the curve, and throw you off the foot-plate if you are not careful, and that is the reason why I say the Baldwin is less destructive than the other.

3900. At what speed do you mean? The same as with the Baldwin engine, 25 miles an hour. I have seen on the road between Tarana and Rydal times when the fireman has not been able to stand on the foot-plate to do his work with the Scotchman.

3901. The Baldwin engine has a four-wheeled bogie? Yes.

3902. Then do you say that a four-wheeled bogie can take a curve easier than a "pony," the Vulcan I believe only had a "pony," that is a two-wheeled bogie, or a pony-truck as it is called? I should think it could.

3903. You are not aware that the principal engineers of America have decided in favour of the two-wheeled truck? No, I do not profess to know anything about these affairs, all I know about is the driving of my engine.

3904. *Mr. Brown.*] That is your special duty; you are not a mechanic? No.

3905. Perhaps it would not be wise to have a mechanic on the engine?

3906. *Mr. Hoyle.*] Then it is only a matter of your opinion as driver? Yes, and what I am told by the permanent-way inspectors.

3907. *Professor Warren.*] And you form that opinion without knowing the actual weights on the driving-wheel? Yes; we are only told to take an engine and to drive her; that is our duty.

3908. *Mr. Brown.*] Until she will not go any further; and then they send for another, and you drive her, eh? Yes.

3909. *Professor Warren.*] I do not say anything about that; I only want to show that if you do not know the weight on the driving-wheel you do not speak from any knowledge, but your own experience? The superintendents say that they would rather have a Baldwin engine over their length than any other engine. As for the weights of the driving-wheel, I do not know anything about them.

3910. *President.*] What I understand is, that you know as a matter of practical experience that the Baldwin engine takes a curve more easily than the Scotch engine? Yes, sir.

3911. It does not give a jump, you say? No, sir.

3912. Have you ever driven when there have been two regular engines drawing the train at once? Only with a pull on the mountains.

3913. Have you ever been aided by having two engines coupled? Yes.

3914. Well, what is your idea of the effect on the road of two engines coupled together, contrasted against the effect of one Baldwin engine? I should think the two engines coupled together would be far more injurious.

3915. Why? I cannot say why, but that is my opinion. Of course I am not prepared to go into these matters, but I give it as my opinion that two engines coupled together would be more injurious to the road than one Baldwin.

3916. You do not think your engine, on the night of the accident, caused the breakage of the rail? No.

3917. Why? Because if the rail had broken with me under my engine we would have all gone overboard, and no one would have been saved; it would have been a far worse accident than it was.

3918. *Professor Warren.*] But an engine may break the rail and yet not leave the rails? Yes, it may happen so, but the chance is that it will leave the rail. However, it is my belief that the engine did not break the rail, and for this reason, the engine-tender was fully loaded with coal and water. I filled with coal at Eskbank, and with water at Wallerawang. I had a horsebox, a louvred fruit van, a first-class composite carriage, and a second-class carriage, all of which passed over the rail besides the leading part of the sleeping car, and that is the reason why I believe the engine did not break the rail.

3919. Is it not likely that the engine may have broken the rail and the remaining carriages may have spread out the iron so that the last carriages were thrown off? If the engine had broken the rail I think the accident would have happened in the first part of the train.

3920. Was the carriage which broke the rail in your opinion—was that a sleeping carriage? Yes, according to the evidence given by two of the passengers, they said it was the bogie of the sleeping car, that is the heaviest car in the train.

3921. *Mr. Middleton.*] It has eight wheels and weighs 22 tons, that is under 3 tons per wheel, whilst the Baldwin engine might have struck $7\frac{1}{2}$ tons.

3922. *Professor Warren.*] So that the weight on the sleeping carriage could not have been half as much as that on the engine? Of course the engine might have broken it, I cannot say.

3923. *Mr. Robert Smith.*] If the Commission will allow me, I might point out, as I conducted the inquest at Bathurst, that it appears on the depositions from the evidence of two witnesses that the accident did not arise from the transverse strain of the weight, but from the leverage of the train on a crack whilst passing over it, it was a lateral strain, that was the view of the jury. I do not know if you have looked at the break in the rail; but if you do, I think you will see that it was not broken by the weight at all.

3924. *Professor Warren.*] You must not say that.

3925. *Mr. Brown.*] We have nothing to do with what the Bathurst jury found. They may find anything they like, it has not got anything to do with this Commission.

3926. *President.*] It appears that the witness, as he has already stated, wrote a letter to the coroner of that inquest, of which he produces a copy, and I think that under the circumstances I had better read it.

J. D. Graham, Esq., P.M., Coroner.

May 2, 1892.

Sir,

I see in the Bathurst *Daily Times* of the 29th April a report of my evidence at the late inquest in connection with the accident at Tarana, and that several questions were answered by me incorrectly. One question I answered as to weight of engine being distributed over twenty-six wheels, whereas it should have been eighteen wheels. My answer to the previous question shows that it was unintentional, as I then correctly gave the number of wheels under engine and tender separately. As regards the weight of Vulcan engine, it should be 75 tons, not 85 as reported, distributed over fourteen wheels. Just about this time I was rather roughly handled by the foreman of the jury, and was rather confused. When I said the average wheel pressure of the Vulcan would be greater than the Baldwin, I did not mean that the weight was actually greater, but that the Vulcan engine from its construction bore more heavily on the rails. When in reply to

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Mr. Smith that I would be fined or punished if I made up time I should have been more explicit, and stated that a recent order had been issued against making up time between stations, especially on falling gradients, and that I would be liable to be dealt with in the usual manner when important orders are disregarded. I much regret that these mistakes crept into my evidence, and respectfully request that you will place this letter (the accuracy of which I am prepared if necessary to state on oath) with my depositions in explanation.

I am, &c.,
H. J. MOSES.

3927. *Professor Warren.*] You consider then that the carriage and not the engine broke the rail? I am not able to form any opinion whatever.

3928. The last straw breaks the camel's back; and it may have been that this last pressure of the heavy sleeping-car finished what had already been begun.

3929. *Mr. Fehon.*] It is a matter which cannot be settled if you talked over it for fifty years.

3930. *Professor Warren.*] I quite agree with you there. My reason was that I did not like any definite opinion to be formed.

3931. *Mr. Hoyle.*] You say that you believe that your engine did not break the rail; will you explain to members of the Commission how it is that as your engine weighed 92 tons total weight, and you had 15 tons 9 cwt. on the driving-wheel, that when the lighter weight of the carriages passed over the rail it broke then and not before.

3932. *Professor Warren.*] He says he cannot answer that; how can he.

3933. *Witness.*] I do not profess to go beyond my driving. My duty is to drive the engine, and I do not pretend to know anything beyond that. It is true that the oscillation of the carriages may have had a tendency to cause the breakage.

3934. *Mr. Fehon.*] In your experience I suppose you have known rails break from various causes, and not altogether from weight? Yes, I have been steadied up from the same part of the road with a Scotch-Yankee; I was steadied up by a red flag when there was a broken rail, and I was told that I must go over the place at 4 miles an hour; that was on the other side of Tarana Station.

3935. You have had no personal experience of broken rails in your own driving? No; this is the first accident I have had anything to do with.

3936. You said you received an order to reduce the speed, was that when the road was being relaid, or lifted with large gangs of men working over it? Yes; when the permanent way was undergoing repair.

3937. A large mileage has been relaid, since the Commissioners came into office, with steel rails, do you know that? Yes; between Bathurst and Tarana.

3938. Eleven miles or more? Yes; laid with new steel rails, iron-bark sleepers and new ballast. Where it has not been relaid it has been newly lifted.

3939. *President.*] Do you know the road well? Yes, sir. I have been over it.

3940. Do you know how far the sleepers are apart at the curve? No, I do not, sir. But I know that on the new curve they are laid latterly very much closer than they used to be.

3941. But this particular part, this is in a new part, is it not? No, sir. It has only been newly lifted, that is packed up with ballast under the sleepers.

3942. You would not take up the sleepers to lift it? You would have to lift the sleepers up with a bar.

3943. Then do you know if the position of the sleepers has been altered at all? No.

3944. *Professor Warren.*] In driving the Baldwin engine, did you like to sit on the side of the engine? Yes; I sat on the side.

3945. Would you rather do that than stand in front? That is just a matter of opinion.

3946. If the engine went over you would have a bad time? Yes. But we do not look at those things. We take our chance.

3947. *Mr. Fehon.*] Either driving or sitting it would be equally bad, how did you find the engine do its work? I found the engine do its work perfectly well.

3948. *Mr. Hoyle.*] Did you ever drive the original Consolidation engine, I mean the old Consolidation goods engine? No.

3949. Have you ever fired them? Yes, I believe I have.

3950. How did they take the road? Well, that is a matter for the goods driver to say.

3951. You only know the Baldwin passenger engine? I cannot say anything about the Baldwin engines outside the new Baldwin passenger engine that I have been driving, but I think that if you were to ask the goods drivers of the other Baldwin engines they would say that they liked them very well, in fact, that they like all that class of engine.

3952. *Mr. Brown.*] However, yours is a good engine? Yes, it is a good engine, and I should be very sorry to lose it.

3953. *Mr. Hoyle.*] As a matter of fact you like the American engines better than the English? Yes; and do not think it is because Mr. Midelton is sitting there that I say so, now.

3954. *Mr. Midelton.*] I do not know you, I do not think I ever saw you.

3955. *Witness.*] I was under you when you were in office, Mr. Midelton.

3956. *Mr. Midelton.*] Yes, I know that.

3957. *Witness.*] We both agreed about the principles of the American engines.

William Wilson, being sworn, said:—

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3958. I am a ganger on the Mount Victoria to Bell section.

3959. *Mr. Hoyle.*] How long have you been a ganger? Twenty-two years.

3960. Is your length iron or steel rails? Part of it is steel and part iron.

3961. Have you had any rails broken on your length recently? Yes, a piece out of the end of a steel rail.

3962. When was that? On the 4th of this month.

3963. *Mr. Fehon.*] I must call attention to the irregularity of the way this information is conveyed. The information which Mr. Hoyle is now asking for has been surreptitiously obtained from the servants of this Department; he could get it in no other way; it is a most irregular proceeding that Mr. Hoyle should be hunting the Department through in the way he is doing. Wherever he can find a disaffected man he gets him and obtains information from him. I know where he has got this information, and I make a public protest that this information is got from disaffected men in the service.

3964.

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3964. *Mr. Hoyle.*] I regret again that so much temper should be shown on the other side. I get my information in no such manner as Mr. Fehon has indicated. I get it legitimately, and I may say that I am conducting my own case and do not want Mr. Fehon to conduct it for me. I got my information from thoroughly legitimate sources. I have had no communication with the employees of the Department, and between myself and my God I swear that I have not spoken to a single employee in the service outside the Sydney yard as to the state of the road.
3965. *Mr. Fehon.*] Where did you get this information from?
3966. *Mr. Hoyle.*] I got no information from the servants of the Department, and I decline to say where I did get the information from.
3967. *President,* to witness.] When did this breakage occur? On the 4th of this month, sir.
3968. Do you mean yesterday? No, sir; yesterday week I mean.
3969. But that was not the 4th of this month; yesterday was the 4th. I mean yesterday week, sir.
3970. *Mr. Fehon.*] It occurred on the 27th of April.
3971. *Witness.*] You could not call it a break; it was only a bit out of it.
3972. *President.*] We do not know how information may be got; that is a matter we have nothing to do with. Mr. Hoyle said he did not get it surreptitiously, and we cannot inquire into that.
3973. *Mr. Hoyle.*] I do not know a single soul on this length, and I never spoke to any man on that length in my life. Surely I shall be allowed to go on without again being insulted in this matter. I would like you to assure the witness, sir, that whatever evidence he gives he will be thoroughly protected in giving it.
3974. *Mr. Fehon.*] There is no need for such a remark. The Commission will take no steps with regard to any witness that comes forward and gives honest and truthful evidence.
3975. *Mr. Hoyle.*] Do you know what state this road was in (to witness)?
3976. *President.*] With reference to the Baldwin engine do you mean?
3977. *Mr. Hoyle.*] Yes, with regard to the Baldwin engine.
3978. *Witness.*] I found no difference in it with regard to the Baldwin engine.
3979. You found that they made no difference:—are you sure? I do not say so, because I could not be sure. They have not been running long enough on the road to justify that.
3980. Has any part of your road been relaid? A mile and a quarter.
3981. When was that? In 1892; this year.
3982. Have you had to open out any of that relaid portion, and pack your sleepers since? Yes, we have.
3983. Have these Baldwin engines been running continuously over your lengths? Yes.
3984. Well, considering that this mile and a quarter was rebalasted and relaid in 1892, do you think it ought to be necessary to open out your road and repack the sleepers? Yes; a new road always requires repacking, the joints in particular. You always find that a new road requires packing.
3985. Have you ever had to remove any defective rails beside this one? New or old rails?
3986. The old rails? Yes; that has been one of the chief works I had to do. The rails got defective, and that was the case before the Baldwin engines came at all.
3987. Were they bad before the engines commenced to run? The iron gets into holes, and the flanges get worn off them.
3988. But were they in a bad state before the Baldwin engines commenced to run? They were not as they ought to be, that is a sure thing. They had been on the road for twenty-two years, and there must be some wear and tear in that time—very considerable, I should say.
3989. Then you consider that these engines have no worse effect than the lighter engines? The only difference is that they used to grind against the high rail on the curve, but any new engine is inclined to do the same thing. It has not got the play of an old engine.
3990. Did you find them knocking your road out of gauge? No, not so much as some of the others, they are better on the road than the 60 class.
3991. You say you have had nothing but a broken rail with a piece out of it since the Baldwin engine has been running? Yes.
3992. What other light engines knock the road about more than the Baldwin engines do? The six-wheel-couple engine, the 60 class do, they were running the mail at one time.
- 3992½. How long ago—about twelve years ago? Yes.
3993. Did you find since the Baldwin engines have been running on your length that there has been a greater liability for the keys to work loose? The keys all depend upon the weather, in hot dry weather they will work loose.
3994. *Mr. Hoyle.*] From the contraction of the wood and expansion of the chair?
3995. *Professor Warren.*] Yes.
3996. *Mr. Brown.*] Twenty-two years you say you have been a ganger? Yes, continuously.
3997. Have you done more of that kind of work since the Baldwin engines have been running than formerly? No.
3998. *Mr. Hoyle.*] Have you had to pack your sleepers oftener since these engines have been running? No, I do not think I have.
3999. Are you sure of it? Yes.
4000. Have you found the joints of your rails that they give you more trouble since these engines have been running? No; joints always work down.
4001. *Professor Warren.*] Are you the ganger on the line where the accident occurred? No; I am on the line between Mount Victoria and Bell.
4002. *Mr. Hoyle.*] I have nothing more to ask.
4003. *Mr. Brown.*] I should think it was very manifest, from the evidence that some of these witnesses give Mr. Hoyle, that you have had no previous conversation with them.
4004. *Mr. Fehon.*] I may as well put in this document to show what this witness was called to prove. It was merely a chip out of the rail. [*Mr. Fehon here put in a diagram showing a section of the rail in question.*]
4005. *Mr. Hoyle.*] I believe Mr. Goodchap was summoned, but I believe he is not present. I hope to finish my case on Tuesday next.
4006. *Professor Warren.*] In that case the Commissioners will be prepared to go on with their case on Wednesday next.
4007. *Mr. Fehon.*] Oh, for that matter, we could go on now; we are quite prepared.
- [Subsequently Mr. Goodchap appeared, and explained that he had not received the summons to attend until that afternoon.]

Walter Marshall Foote, being sworn, said :—

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4008. I am an iron and steel worker and maker, and have had some thirteen or fourteen years' experience in that trade in the old country.

4009. *President.*] Have you done any of that kind of work here? There is none of it done here at the present time; I am preparing the way for it.

4010. *Mr. Hoyle.*] Have you had much experience in the manufacture of iron and steel rails? Yes.

4011. Could you tell me where your experience has been gained? Yes; I had experience at Swindon, Llandore, Dowlais, and Tredegar.

4012. Have you had some experience of the Welsh manufactured steel? Yes.

4013. You have heard the evidence in this case? Yes.

4014. And you have heard it stated in the evidence that the bogie axles of these engines ran hot, and that the running hot was attributed to the working out of cinder through the laminations of the iron;—now, from your experience as an iron manufacturer, do you think that their running hot could be caused in that way? Well, if any man were to make a statement of that kind to me, and said at the same time that he knew anything about iron, I should think that he was either crazy or had been drinking.

4015. Then do I understand you to say that the working out of cinder would not cause the bogies to run hot? Certainly not. I do not see how cinder could work out of a cold axle, the iron of which axle is malleable, and worked together by a steam-hammer. The axles are either forged into shape or rolled out, and the journals are turned up afterwards. Between the bars of iron that are welded together there are usually certain impurities, and it requires the application of very great heat to get these out. There is always a certain quantity of this cinder between the particles of iron, just as you will see ice between gravel-stones. There is always some of this left in the axle, and before it could work out the axle would require to be tremendously hot. But for any man to talk about it working out of a cold axle in the form of grit, and so producing friction between the journal and its brass, would show that he knew nothing about what he was saying.

4016. *President.*] You say that it must be at a very great heat before it will work out?

4017. *Professor Warren.*] And that the iron must be hammered or rolled? Yes. Before it could work out it would have to be tremendously hot, over orange red, which is very nearly welding heat, representing a temperature of 2,100 degrees or something over.

4018. *Mr. Hoyle.*] If it were shown that any axles were shedding cinder, could it possibly be that this came from the inner portion of the axle? No; it is simply impossible. There might, perhaps, be some scales on the outside of the axles which had not been cleaned off, but I do not think so, because the action of the tool in the lathe would probably take off any such small laminations or scales.

4019. Could it be produced through roughness of workmanship in making the axle;—could the heating take place by reason of the rough scaly surface on the journal? I think it very probable that that might have led to heating; that is to say, if the journals were roughly turned, and did not present a clean surface to the brass; but it might also be occasioned through want of lubrication.

4020. *Mr. Fehon.*] It is admitted by the Railway Commissioners that a journal has been twisted off, and that these axles have been replaced by, and at the expense of, the Baldwin Company; is it necessary to go into the question of the material of these axles, does it matter at all?

4021. *President.*] This evidence I take it goes to show that the running hot could not have been brought about by the working out of cinder as has been suggested.

4022. *Mr. Hoyle.*] I want to show that it is through a defect in the design of these engines that they are running hot. (To Witness.) How would you account for the axle twisting off? It was one of four on a bogie truck, the wheel was twisted off it, and the end of the axle itself was tapered off in that fashion [*drawing a rough design*], and showed signs of the wheel, with the boss, having been twisted off; it was twisted off just as you might take the end off a lump of putty; I examined the metal and I saw it was such stuff as I should be sorry to ride over in a railway carriage. It was very inferior metal indeed, just a common, rough, scrap-forging.

4023. Do you think the twisting could be caused by one wheel being larger than another? No, I do not. I think it was caused by the wheel jamming in the brasses, and that I think caused it to twist itself off, with the momentum of the train behind it forcing it to revolve, or twist off.

4024. Why if this cinder did not work out did the bearings run hot? Well, I think the chief reason must have been the inferior, and I might say the rough quality, of the metal, coupled with the inefficient means of lubrication. The only means of lubrication that I could discover were small oil cups without oil reservoirs, and of such small capacity that if a driver wanted to keep his axle brasses cool he would have to pull up his train every few miles in order to put oil in them.

4025. *Professor Warren.*] It was not due to insufficient bearing on the surface of the brasses? No, although they appeared to be rather small and narrow.

4026. You have stated several ways in which the bearings might have run hot, and there is just one other way, namely, one of insufficient bearing surface, and that is why I mention it? The brasses were smaller than the usual size, but not small enough to cause the heating of them. One was shown to me, I may mention, in which the heat had been so great that the inner face was fused—I am referring to the brasses; and the brass that had been fused seemed to have been of a very inferior quality. I saw no trace of white metal in it, such as it is usual to put in English brasses.

4027. *Mr. Hoyle.*] Did you examine the brasses of the axles? One was shown to me in which the brass had been fused, and, as I have just said, I saw no white metal in it such as is usually put into English brasses. In England it is customary to let white metal into the brasses in order to equalise the wearing of the bearing surface.

4028. You say that the breaking of these axles arose from the fact there was insufficient lubrication, and the material out of which the axles were made was bad? Yes; that combined with the fact that the brasses jammed on the journals.

4029. *Professor Warren.*] Mr. Hoyle asked you what was the cause of the axle breaking; I suppose he only referred to that axle which was twisted? Yes, so I understood; and I spoke only so far as I saw that particular axle.

4030. *Mr. Brown.*] The one that came into Redfern was twisted off.

4031. *Mr. Hoyle.*] The journal of a tender axle on the Newcastle line also was broken.

4032. *Witness.*] I was informed that this axle was from Newcastle. I took an opportunity whilst I was there of looking at some other wheels and axles, and they seemed to be of the same material and workmanship.

4033. From your experience as an iron manufacturer, will you tell me whether, in your opinion, these axles were hammered or rolled? They seem to me to be rough forgings.

4034. Of course you know from the evidence the weight of the Baldwin passenger engines? Yes.

4035. And have you closely examined the broken rail? I have seen it since it has been in the room.

4036. You have had some large experience in the manufacture of rails;—will you now examine the rail carefully, and give us your opinion as to the weight it ought to carry, and also your opinion as to how it was broken?

4037. *Mr. Fehon.*] I must appeal against any evidence being given about the material in the broken rail, or indeed anything else that refers to it, except as affecting the Baldwin engines.

4038. *Professor Warren.*] Of course.

4039. *Mr. Brown.*] I think when you say that, you give up the whole case; all those particulars affect the question of the Baldwin engines.

4040. *Professor Warren.*] How the rail was broken is very important, since the Baldwin engines pass over it.

4041. *Mr. Fehon.*] As to the spacing between the sleepers, and any question as to the construction of the permanent way, I admit it comes properly within the scope of the inquiry; and I may say further that we admit at once that this rail is a bad one. Any one who understands iron at all will see that it is not a good rail. It developed a defect which it is impossible to see, and that defect only shows itself after the rail had been used for many years. It would have been impossible for any one to have detected the defect before the rail actually broke.

4042. *President.*] If it had lasted for a number of years, does that prove it a bad rail;—would it not get into a granulated condition, such as was spoken of?

4043. *Mr. Fehon.*] Yes; as a rule iron rails will stand the same test after a few years' wear, making allowance for the iron that has been worn off the face of the rail. A rail should stand a test nearly equal to its original test, allowing, as I say, for the iron that has been worn off. That particular rail would weigh within a fraction of a pound of its original weight.

4044. *Mr. Brown.*] You are now giving unsworn evidence, Mr. Fehon, as against sworn testimony, and that is surely not right.

4045. *Professor Warren.*] It is not evidence at all.

4046. *President.*] We shall quite understand when we come to consider the evidence before arriving at our decision that you are now only speaking by way of argument. We want to know what objection you have to the course Mr. Hoyle proposes to take?

4047. *Mr. Fehon.*] I was explaining whether the quality of the rail should not be taken into consideration by this Commission. Whether the engine broke the rail, or whether the carriage broke it, or anything else, is immaterial to this inquiry. The rail developed a flaw—a weakness—that was the cause of the accident, and it was impossible for the men on the road—the Railway Commissioners, or anyone else throughout the length and breadth of this department—to know that it was a defective rail.

4048. *President.*] Exactly. But how will the proposed evidence hurt you, and what is more, how is it inadmissible whether it will hurt you or not?

4049. *Mr. Fehon.*] I understand that Mr. Hoyle wants to examine Mr. Foote on the quality of the material used in the rail. But the quality of the iron, I submit, has nothing whatever to do with the effect of the Baldwin engine upon the rail.

4050. *President.*] It is part of the permanent way, is it not?

4051. *Mr. Fehon.*] When the Commissioners took charge of the road they had to take everything upon the strength of its appearance, and soon after we took charge we had to lay 250 miles of new rails.

4052. *President.*] This defective rail, however, was a part of the permanent way, was it not, and the purpose of the inquiry is to find out whether the Baldwin engines are suitable to the permanent way. As I understand it, a piece of iron may, without any warning, give way at any time. There is no imputation that you were at fault in regard to this breakage, and you cannot object to Mr. Hoyle putting the question. Its value, or the value of the evidence that it will elicit, is quite another thing.

4053. *Mr. Fehon.*] My only object in making the remark is that no fault may be attached in this inquiry to the quality of the iron that this rail is made of.

4054. *Professor Warren.*] But do you not think that, assuming that the rail is of a good quality of iron it would have a very important bearing upon the case.

4055. *Mr. Fehon.*] We know this is not a good quality, we have made tests of it and discovered for ourselves.

4056. *Professor Warren.*] Have you made tensile tests? No; we have not made tensile tests, we have only made drop tests.

4057. Will you make tensile tests, and supply the Commission with the result of them? The drop test is a very good thing in its way, I think a great deal of it, but it is not everything. The real quality of the iron is best discovered by making tensile tests and ductility tests.

4058. *Mr. Fehon.*] I may say that if the Commissioners had known the state of the rail they would not have allowed the lightest engine to run on it.

4059. *Mr. Brown.*] I understand that this inquiry has become more complicated by the recent accident at Tarana. We were called upon to decide whether the Baldwin engines were suitable to the permanent way, and in the meantime an accident of a very serious character has taken place.

4060. Are we not called upon as a Commission to decide not only with regard to the suitability of the Baldwin engines to the rest of the road, but also as to whether the Baldwin engines ought to run over that portion of the road of which this rail was a part; is not that the position in which the Commission find themselves to-day.

4061. *Mr. Fehon.*] It is not for me to define the extent of the Commission.

4062. *Mr. Brown.*] I very much wish that the question involved in the breaking of this rail had never arisen, because the matter would then not have been complicated by it, but in-as-much as it has arisen I feel that it is part of the Commission to inquire into it.

4063. *Mr. Hoyle.*] I hold in my hand the report of Mr. Price Williams of August 10th, 1889, which led me to make this one important charge, because Mr. P. Williams states where certain rails ought to have been taken out and other rails put in, and that has not been done, and we have no evidence to show that there are not similar rails on the road at present.

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Mr. W. M. Foote. 4064. *Mr. Brown.*] Well, if you are going to put it on that ground, it is a very different thing; there may be negligence, I do not say whether there has been or not, and I should not like to give an opinion upon the question, but it is not material, I think. You must look upon the permanent-way as a whole. If there are certain parts in which there are known defects it is the fault of the officers who ought to look after it; but it would be very wrong for us to allow you to go into that question now. It is not included in our Commission. The permanent way means the permanent-way of the Colony, and what we are called upon to consider is whether the Baldwin engines were suitable or unsuitable for the permanent-way; it is supposed to be in good condition. No engine should be allowed to run over rails that are really defective.

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4065-6. *President.*] What is the authority delegated to this Commission? It is to examine whether the Baldwin engines are suitable to run over the permanent-way of the Colony. That is, supposing that the rail is made of good iron, that it is properly weighted and properly fastened down, and it is apart from the question whether or not somebody has said that these rails should be taken up. I think this is admissible evidence to show that this rail is a good or bad piece of iron. But in this Commission inquiry into negligence might interfere with any actions that may be brought against the Commissioners in connection with the recent accident. (To Mr. Hoyle):] You may ask Mr. Foote to examine this rail and say whether it is good or bad iron. It is all in your favour if it is good iron, and if it is bad iron it is not in your favour so far as this inquiry is concerned.

4067. *Mr. Hoyle* (to Witness).] I would ask you to make a careful examination of this rail. I want you, Mr. Foote, to say whether it is good or bad iron; you must remember that you are on your oath, and you must be just to the Commissioners and to myself. Examine it carefully.

4068. [*Witness proceeded to make a careful examination of the broken rail*], after which Professor Warren said: These rails have been faced in certain places, there was no necessity to do that, was there; I suppose they were cut, and faced afterwards? I suppose so; those are the breaks, where the red paint is, I believe.

4069. *President.*] Which side of the line was the broken rail on?

4070. *Mr. Foote.*] The left-hand side as you sit facing the engine going from Sydney.

4071. *Professor Warren* (to Witness).] Do you think it broke as a result of lateral pressure? I do not see the slightest sign of that in the fracture. If there was any sign of that in the fracture there would be a set of the fibres, and there is no indication of that. This depression in the running face of the rail is evidently not the result of steady running, but the result of some other movement, and you want to find out what caused that to happen.

4072. You think that it was something, as it were, jumped on the rail that caused the break? Yes, something causing a sudden blow, and of course that something has yet to be found out.

4073. *Mr. Hoyle.*] Have you examined that rail thoroughly? I have.

4074. And what is your opinion of the quality of the material? My opinion is that the quality of the material is good and fit for any purpose, but there are one or two small signs in the web of the rail of the presence of cinder, but nothing to affect the strength of the rail. I should say that the rail, when new, was a good and sound one, and fit for the use that has been made of it.

4075. Do you consider then, taking into consideration the strength and manufacture of the rail, that it could be broken by the weight of the wheels of a carriage? No; I certainly do not.

4076. You must reckon 3 tons on each of the wheels of the carriage;—do you consider that that was enough to break it? No; I certainly think not. I do not think it would be possible to break it with the weight that there is upon a carriage wheel unless you lifted the carriage up several feet and then let it drop on the rail, and even then I doubt if you would break it; but with ordinary traffic I do not think that the rail could be broken by a carriage wheel.

4077. Do you think it is a clean break? No; I regard it as a tear.

4078. Do you think that it was done at the one time, or that there was a flaw previously? I think there is evidence of a crack extending from the lower head of the rail about one-third of the way up the web; and then there is a fresh crack that has evidently been caused quite recently extending backwards; and then from the edge of that crack, which is where the original flaw ends, there is a diagonal fracture or tear up to the upper head of the rail.

4079. Well, do you think that the weight of the engine could break the rail? Not if the weight was steadily applied, but since I have examined it I have seen a rather serious depression on the head of the rail just above where the fracture begins, and I think that we ought to examine the rail on the other side of the break to see what made the engine jump. I think she must have jumped. If she had run steadily over it I think it might have carried her safely; or might not.

4080. You cannot account then for the fracture unless by saying there must have been some unevenness of running on the part of the engine? Well, suppose it could be done this way: You say we might take these pencils to be three sleepers, and this one will be the rail on the top, suppose that the two outer sleepers were high and the middle one low, and consequently the rail lower on the centre than upon the two higher sleepers;—do you think that passing over the lowest portion of the rail the engine would jump unduly? Yes, most decidedly; and it would very probably fracture the rail if the depression were a serious one.

4081. Could it be done that way by the sleepers being uneven? Yes.

4082. With sleepers laid at a distance of about 2 ft. 8 in. from the centre? Yes; quite easily.

4083. But do you think that it could be caused by a carriage exactly in the same way? No; I do not, unless the weight on the carriage wheels was a great deal more than you have mentioned. You must remember that that rail was an iron rail, and therefore rather more pliable than a steel rail would be.

4084. As this was a cold night—of course I want to be very fair in this matter—if it was a cold, frosty night, as we know that it was, do you think that owing to the cold temperature the rail could be broken by the wheels of a carriage passing over it? In the first place, I should like to know about what the temperature was;—was it somewhere about zero? I cannot say what the temperature was there. We could find out by Tuesday. I think it would be better to do so before answering a question of that kind. It would be better if you could refer to the Government Astronomer.

4085. But the temperature would have something to do with the breaking of the rail, would it not? The temperature might affect it, but not to the extent that some people think.

4086. *President.*] Supposing it were freezing—you couldn't put it stronger than that I should think—would

would that make the rail break more readily than it would in the ordinary May weather on the mountains? Well, it would make it a little more brittle than it would be at the ordinary temperature, but I am not prepared to say that it would make an ordinary carriage wheel able to break it. I do not think it would.

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4087. *Mr. Hoyle.*] Then you do not think, as a matter of fact, that the weight on any of the carriage wheels could break that rail? I do not think that the weights that you have mentioned as being those of the carriages could break the rail. Of course, if you bring along a carriage above normal weight it is a different thing.

4088. Say a carriage of $3\frac{1}{2}$ tons on each wheel? No, I certainly do not think so.

4089. Do you think that had this rail been steel it would have been perfectly safe with the Baldwin engine going over it? With a weight of 15 tons 9 cwt. on the driving-wheel, the rail being a 71-lb. single T rail, you mean?

4090. Yes? I do not think it would be advisable to run such a weight over it.

4091. *Mr. Fehon.*] As a matter of fact, the weight on the driving-wheels is not 15 tons 9 cwt.; it is 15 tons 6 cwt.

4092. *Mr. Hoyle.*] You do not think it would be advisable to run an engine of that weight over a 71-lb. steel-rail? No; I do not think it would. The practice in other countries is to use very much heavier rails for such locomotives as I see in these photographs.

4093. Do you know anything about the way in which rails are laid in England? No; I have never had anything to do with permanent-way work. My experience has been confined to the making of the rails; I have had nothing to do with laying them.

4094. Did you examine the wheels of these locomotives? Yes; I had an opportunity of examining them when I accompanied the Commission through the engine-shed at Eveleigh; I think it was last week.

4095. Having viewed these wheels; having seen what appear to be fractures or cracks in the spokes, do you consider them safe? Well, according to the hammer-test of those spokes, I should decidedly say that a great many of them were not sound. As a matter of fact, however, you could hardly tell what the actual state of those spokes was unless you could get a wheel and have the paint scrubbed off, and the wheel made perfectly clean. We were at a little disadvantage the other day because the wheels were painted, and the flaws were puttied up. Unless we had a wheel scraped quite clean—the paint and putty burnt out, for example—it would be perfectly impossible to say whether the spokes are properly welded. As far as I understand they consist of two half-round bars of iron welded together, and, of course, if the welding is good the spoke becomes as perfect and as strong as a solid bar; but if they are not properly welded together, then the spokes are imperfect. From the hammer-test the other day I am strongly of opinion that, if the wheels were properly cleaned and scraped, we should find many of them imperfect, in consequence of imperfect welding.

4096. In other words, there are galls in the iron? Well, I do not know whether the flaws would be due to cinder in the iron or to imperfect welding, but that the wheels are imperfect the hammer-test certainly indicated.

4097. *President.*] They are imperfect? Yes; there is no doubt that some of the spokes are imperfect.

4098. *Mr. Hoyle.*] Looking at the wheel itself, have you any notion of the strain that would be placed upon the wheels by the shrinking of the tire? I do not know that I could give an opinion on that from the examination I made of the wheel.

4099. If the tire was a little small and was shrunk on to the wheel, the compression that must necessarily take place would affect the wheel more or less, I suppose.—Do you think, for instance, that if there was too much compression—if very great care had not been taken in putting the tire on to the wheel, in boring it out to fit on to the band of the wheel—such defects as you have seen might arise as a consequence? One of two things might happen: either the tire might become unduly strained, or the extra pressure placed upon the wheel might cause the spokes to open, particularly if there were any imperfect welds in them. If excessive pressure were brought to bear upon the wheel in such a way, I think the tire might be unduly strained, and that would affect its strength, or else if the tire held good the pressure might tend to open up the imperfect welds in the spokes. Whether such has been the case or not it is impossible to say upon the examination made by me, because if the imperfect welds were filled up with putty you could not see them properly.

4100. *Professor Warren.*] That is to say, that if the wheel were put into the fire and all the putty scraped off, then you could tell what it was like? Exactly; that is what ought to be done. If one of these wheels were put in the fire and the putty burnt out, we should have a much better chance of telling what the wheel was like.

4101. Have you anything to do with the making of these wheels? No.

4102. Have you ever seen it done? Yes; there was a large wheel shop at Swindon, where I served my time.

4103. You are speaking with some knowledge of the subject. Apparently you are. But I wanted to know whether you have had any experience in the actual manufacture of these wheels? If I had not, I could not venture an opinion.

4104. *Mr. Hoyle.*] Supposing that we put one of these wheels into a furnace and raised it into a blood-red heat, and a little water were sprinkled over it, could we discover whether there were serious defects or not? First of all you would have to burn the paint off.

4105. I mean put it into a furnace and let it get blood-red hot, and then clean it with a file, and then pour water on to it. Would not that be a good test? It would tend to open up imperfect welds, but it would not open them up very much. I doubt whether a blood-red would do; it would have to be more of a bright-red heat.

4106. *Mr. Fehon.*] What drop test should that rail stand? Do you mean in the way of tons?

4107. A ton weight falling on that rail, say on 3 feet bearing centres, how much weight should it stand? That rail certainly ought to stand 22 tons if sound.

4108. *Professor Warren.*] Foot tons, you mean? Yes.

4109. *Mr. Fehon.*] At a fall of how many feet to one ton? It would be equivalent to a fall of about 7 feet 6 inches or 8 feet.

4110. *Professor Warren.*] Do you mean to say that you would repeat it to make it to 22 tons? No; at one drop I mean.

4111. *Mr. Fehon.*] But that rail should stand a blow of 22 tons without breaking? Equal to a fall of 22 tons raised one foot and dropped.

4112.

- Mr. W. M. Foote. 4112. Are you aware that broken rails both of steel and iron are of frequent occurrence on different railways? I am quite aware that rails do break on railways from various causes.
- 5 May, 1892. 4113. Are you a member of the Institute of Civil Engineers? No.
4114. Are you a member of the Institute of Mechanical Engineers? No.
4115. How long have you been in the Colony? About nine years.
4116. Have you followed your profession since you have been here? As lecturer to the Government on iron and steel manufacture.
4117. How long have you followed your occupation in that capacity? I took a long engagement in 1885 as a lecturer under the Board of Technical Education in Sydney and various parts of the Colony, and the year before last I filled a similar position under the Education Department.
4118. What position do you occupy now? I am a journalist.
4119. Are you not the contributor of various articles that have appeared in the *Sunday Times* condemning the Baldwin engines?
4120. Mr. Hoyle.] I do not see what that has to do with it.
4121. President.] If he has written articles condemning them, it is possible that his evidence may be unfairly tinged with a bias in favor of the views that he has expressed in those articles. That, I presume, is what Mr. Fehon wishes to get at, and it is a perfectly fair question.
4122. Mr. Fehon.] Have you written the articles that I have referred to in the *Sunday Times*? I think, according to the ordinary rules of journalism, I should not be expected to answer such a question.
4123. At all events you are not prepared to say that you did not write them? I am not prepared to answer the question at all.
4124. That will do; I am perfectly satisfied with that answer.
4125. President.] At all events, Mr. Foote, if you have any authority with the *Sunday Times*, I would suggest that it would be fair in every way, and more consistent with the views which that paper sometimes advocates, that there should be no comment about this Commission whilst the case is proceeding. I say this because I happened to see a copy of last Sunday's *Sunday Times*. I think it would be much better if no comments were made upon the work of the Commission whilst it is sitting. If the *Sunday Times* is opposed to the Baldwin engines such a course will not further its object, and it is not fair to Mr. Hoyle, because it cannot do his side anything but harm. I am not saying this unkindly at all. Of course I cannot forbid comments, as a court could, but I just mention the matter to you in the hope that you will accept my suggestion.
4126. Witness.] I will make it my business to mention what you have said to the editor.

TUESDAY, 10 MAY, 1892.

[The Commission met at 2 o'clock, in the Board-room of the Colonial Secretary's Office.]

Present:—

F. E. ROGERS, ESQ., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E., | ALEXANDER BROWN, Esq., M.L.C., J.P.

Charles Augustus Goodchap, being sworn, said:—

- C. A. Goodchap, Esq. 4127. Before the present Commissioners were appointed I was Commissioner for the railways of New South Wales, and held that position for eleven or twelve years. The whole of the railways of the Colony were at that time under my supervision. At the present time I am a member of the Legislative Council.
- 10 May, 1892. 4128. Mr. Hoyle.] Whilst you were Commissioner for Railways do you know whether, when new structures were being made on the road, that the gauges in existence were adhered to—that is to say, that the distance from the rails to the platforms was in every case uniform? Yes.
4129. You say that the gauge was always adhered to? Yes, I believe so. I should have made some objection if I had understood that they were not adhered to. It went without saying that the gauge of the lines was always the same.
4130. And has been uniform? Yes.
4131. Whilst you were Commissioner for Railways, did Mr. Halligan make some recommendation with regard to the widening of the platforms on the Northern Line? I have not any recollection of his doing so.
4132. Do you know the weight of a Baldwin passenger engine, and the consolidation goods Baldwin engine?
4133. Mr. Fehon.] I would ask if it is a fair position to place Mr. Goodchap in, to ask him this question. The Railway Commissioners have abstained since they have been in office from reviewing what had been done during Mr. Goodchap's administration. Mr. Hoyle has asked Mr. Goodchap a question with reference to the Baldwin engine; we, I say, have carefully abstained from opening up or reviewing any of Mr. Goodchap's actions during his administration, and it is scarcely fair to put him in a position of criticising the Commissioners' actions as an expert, as he may know nothing about this particular engine under inquiry.
4134. President.] It is a matter of taste for Mr. Hoyle, and also a question for Mr. Goodchap himself to consider whether he is inclined to answer the question or not.
4135. Mr. Fehon.] I only raised the question because I thought it proper to do so.
4136. President.] Mr. Goodchap is asked if he knows the weights of these engines, and we have it in evidence what these weights were.
4137. Mr. Hoyle.] I do not desire to open up the question of the management of the railways. I only want to ask certain questions as to the Baldwin engines alone.
4138. President.] We shall see whether it is admissible, and whether Mr. Goodchap has the requisite personal knowledge to answer it. You may ask it, but I do not know whether he is prepared to answer it or not.
4139. Mr. Hoyle.] The weight of the passenger engines, Mr. Goodchap, is 92 tons, with a weight on the driving-wheel of 15 tons 9 cwt. The Baldwin consolidation engine weighs 97 tons with a weight of 16 tons 9 cwt. on the second driving-wheel? Yes.
4140. You are aware that a Royal Commission sat upon certain questions relative to the bridges of the Colony.

Colony. Can you tell us whether any alterations have been made to these bridges since that report was brought out? Some alterations were made during the time that I was Commissioner, after the report of the Commission was made, but I am not aware that any alteration has been made since October, 1888.

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4141. With your knowledge of the permanent-way, and of the age of the road, and now knowing the weight of these engines, do you consider these engines safe to travel over the permanent-way, with your experience of railway management?

4142. *President.*] Are you an engineer in any way, Mr. Goodchap? Not a professing engineer.

4143. Are you in a position to express an opinion of any value upon this matter; for instance, I might think a person was sick of a certain thing, but that would not be the opinion of a doctor. Other persons have been asked this question—an engine-driver—but the opinion of a high-class Civil engineer would, I should think, from my view, carry more weight if he expressed it, and chose to say what that opinion was.

4144. *Mr. Fehon.*] I will call attention to the fact that Mr. Hoyle has mis-stated the weights.

4145. *Mr. Brown.*] Has Mr. Hoyle finished his question?

4146. *President.*] This might happen to be a very unpleasant thing, and place Mr. Goodchap in a very unpleasant position, but if he has sufficient knowledge to answer the question, of course he may answer it; but I do not want any opinion to be got unless Mr. Goodchap says that he has a special knowledge upon this question to enable him to answer it.

4147. *Mr. Brown.*] Put your question again, Mr. Hoyle?

4148. *Mr. Hoyle.*] Perhaps I have miscalculated the weights, but if so, that is not my fault, I have asked the Commissioners for the diagram, but I have not received them, and have not got them before me.

4149. *Mr. Brown.*] It is an important question you are going to put, and perhaps the Railway Commissioners can give you the weights.

4150. *Mr. Fehon.*] The weights are 15 tons 6 cwt. on the driving wheels of the passenger engine, and 15 tons 9 cwt. on the driving wheel of the Consolidation goods train.

4151. *Mr. Hoyle.*] With a total weight on the driving wheel of the passenger Baldwin engine of 15 tons 6 cwt. and a total weight of 15 tons 9 cwt. on the driving wheel of the Consolidation engine, do you consider—taking into consideration your experience in railway matters—that that weight is too great for the permanent-way of New South Wales, that is with the iron and steel rails, steel rails being 71 lb., and the iron rails 75 lb.? I think you have left out an important factor in your question, namely, the speed at which the engine is driven.

4152. The speed of the passenger engine is 25 miles an hour, and on the Consolidation goods engine it is, I think, 18 miles an hour.

4153. *Professor Warren.*] The rate of the passenger engine I think is 40 miles an hour.

4154. *Mr. Hoyle.*] Well, then at a rate of 40 miles an hour for the passenger engine, and of 18 miles an hour for the goods engine? I should think the weight of the goods engine would be immaterial if it were driven at not more than 18 miles an hour, but I consider that a passenger engine driven at 40 miles an hour round 8-chain curves—if driven at that rate round the curves——

4155. *Mr. Fehon.*] They are driven at 25 miles an hour on roads with curves and with down grades, evidence has been given before this Commission that 25 miles an hour was the speed of the train at the time of the accident at Tarana, that speed was an instruction to the men, it is only on a straight level road that the engines would run at the speed of 40 miles an hour.

4156. *President.*] I understand that down grades and round curves the drivers are not permitted to go at a speed beyond 25 miles an hour. Now Mr. Goodchap, taking that fact into consideration what do you say is your opinion? I should certainly say the weight is not excessive for the road, provided, of course, that the road is in good order and well sleepered.

4157. *Mr. Brown.*] That is to say, provided the road is now as you knew it to be in your time? I see by some evidence that has been given that the sleepers were said to be over 3 feet apart, well I consider that to be a very dangerous thing.

4158. *President.*] But you know the road as you left it. Suppose it had been kept in a proper state of repair since you left, would the weight then be excessive? I think not at the speed stated.

4159. *Mr. Hoyle.*] In taking the speed of from 30 to 40 miles an hour, and with the sleepers 3 ft. 2 in. and 3 ft. 4 in. apart, what would your opinion be?

4160. *Mr. Fehon.*] The regulation width is 2 ft. 7 in. All the new road relaid by the Commissioners is 2 ft. 7 in. in width from centre to centre.

4161. *Mr. Hoyle.*] I have measured the road at Tarana, and I have found the sleepers to be from 3 ft. to 3½ ft. from centre to centre. Now, Mr. Goodchap, taking into consideration that there are places in our road where the sleepers are 3 ft. apart, and that a train travelling at 40 miles an hour, with the weight I have stated on the driving-wheel, do you consider it safe? Well, I think it is a debatable point.

4162. *Mr. Brown.*] But you won't say it is unsafe? I won't say it is unsafe.

4163. *Mr. Hoyle.*] When orders were sent out of the Colony for rolling-stock was the weight taken into consideration? Certainly.

4164. In all cases? Yes, the report from the engineer was sent to the head of the permanent-way, and the weights were referred to him, in order to see if they were proportioned to the rails and the works on the line.

4165. They were referred, you say, to the engineer of the permanent-way? Yes.

4166. The one officer corrected the other? Yes.

4167. I suppose it is unnecessary to ask if it is usual to supply specifications? Yes, they were always supplied, unless we ordered a special class of engines. For example, No. 105 class; there was no specification sent; they were engines constructed by the Baldwin Engine Company, and that class was ordered for its good repute and for the work which it had done in other countries.

4168. You ordered then from the published design of the engine, you took the published design as submitted to you by the Baldwin Company into consideration? Certainly; I am not sure that the Baldwin Company suggested these designs to us, but it was from that Company that we ordered them.

4169. *President.*] You sent for them in consequence of their design? Yes, but I do not think it was at their instance.

4170. *Professor Warren.*] You knew it to be a suitable class of engine for the railway, and sent for it in consequence of that? Yes.

4171. *Mr. Hoyle.*] Would you approve, if you were in power to-morrow, of engines travelling at the rate of 40 miles an hour with the weight of the Baldwin passenger engine over a straight road? I should be guided

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guided entirely by the Permanent-way Engineers. I should refer the matter to them, and ask them would an engine with that weight on its driving-wheels driven at 40 miles an hour over that road be safe; and if the Permanent-way Engineer said it would be safe, I should authorise it.

4172. *Mr. Brown.*] Have you seen any of the Baldwin passenger engines here? No.

4173. Have you ever seen them elsewhere? I have seen the Consolidation engine in America; it is a similar class to the goods engine here.

4174. Would you consider that class of engine suitable to the permanent-way of New South Wales? So far did I consider it suitable that I got a drawing or engraving of it, with full particulars of hauling power, from the Baldwin Engine Company when I was in Philadelphia, with the object of bringing it under the attention of the present Commissioners as an engine which I thought would be very suitable for our lines.

4175. *President.*] For the purpose of recommending this engine? Yes; I am alluding to the Consolidation engine. I regarded it as being very suitable for our roads, believing that it would not be driven at a greater speed than 18 or 20 miles an hour.

4176. *Professor Warren.*] And your intention was to work the Blue Mountain and Picton grade with it? Yes, in order to take up a good load, which with our present engines we were unable to do; with a view to the reduction of working expenses and a reasonable charge to those who send their goods by rail, the greater the load that could be carried the less, of course, would be the expense of carrying.

4177. Per ton you mean? Yes, of course, per ton.

4178. *Mr. Brown.*] Is the Baldwin Engine Company considered a respectable firm? Yes, the leading firm in America.

4179. Suppose that you heard that the axles of the engines imported here were bad in material, would you consider that dishonest on the part of the firm? No; very few engine-makers make their own axles, they arrange with other firms for their manufacture, and stipulate for the best material to be put in the axles no doubt they are disappointed at times, the same as in other matters.

4180. And you regard that as an accident on the part of the company? Yes; certainly. My opinion of the company is very high, and I am sure they would not do anything of a dishonest character. In my time they always came forward and accepted the responsibility wherever it was proved that they were in the wrong.

4181. *Mr. Hoyle.*] Whilst you were Commissioner did you receive any reports from any of the permanent-way officers as to the weight of the engines running on the line? No.

4182. Have you the weights of the engines you saw in America? I think there was 135,000 lb. actual weight on the eight driving-wheels. That was in a paper drawn up by the company. That gives 15 tons 1 cwt. on each pair of driving-wheels. That was drawn up by the company itself.

4183. *Professor Warren.*] That corresponds with 15 tons 9 cwt. on the driving-wheel of the present Baldwin so that it is practically the same engine.

4184. *Mr. Fehon.*] Yes, exactly.

4185. *President.*] That is on each axle? Yes—each pair of wheels.

4186. *Witness.*] I would like to make some observations with regard to some evidence given to the Commission published in a newspaper about the weight on the driving-wheels of certain engines, the weight on which it was said was greater than the weight on some of the Baldwin engines.

4187. *Professor Warren.*] Yes.

4188. *Witness.*] I should like to say with reference to that, whilst the fact is that this engine did weigh more, it was well known to the Department that it was a condemned engine, and if I may be permitted I can explain it by some observation I made in the Legislative Assembly on the alleged state of the rolling stock. This was a tank engine which had been introduced by a locomotive engineer of the name of Burnett, and I think I cannot do better than read this extract from my speech on that occasion. The papers in the office will support the remarks I made there: "There was also recommended for the suburban lines a tank engine which I venture to say, judging from the reports made to me by the officers, for I do not profess to be a permanent-way or locomotive engineer, I am speaking upon reports made by men placed in charge of various departments as engineers, and whose duty it was to advise me upon these points. I was about to say that according to these reports this particular engine, introduced by Mr. Burnett, has cut the suburban line all to pieces. This is the engine which is to be selected as a future type." At that time it was proposed to take this heavily weighted engine for a suburban tank engine; I believe they have been taken off the suburban line, and have been sent up north to work on the coal lines. That engine, as I said, cut the suburban line all to pieces. I then went on to say, "It is an engine of which Messrs. Beyer, Peacock, & Co. are the makers. Mr. Burnett is responsible for the introduction of that engine upon our lines, and it was one of the circumstances which led to his removal from the Railway service. A type of engine had been used upon the line which weighed 29 tons, and orders had been repeated for that style of engine. Mr. Burnett, after calculating the tractive force of the engine, having regard to the work for which it was required, recommended that an engine weighing 33 tons should be adopted in its place. After consultation with other officers whose advice I could obtain, this recommendation was agreed to. But when the engine arrived in the Colony it was found that, either from a miscalculation as to the weight of the parts, or because the manufacturers wanted to make an engine of that character, it weighed 40 tons—that is, 11 tons in excess of the engine in use, and 7 or 8 tons in excess of the weight authorised. This is the engine which the Locomotive Engineer is recommending to be used." I should have said nothing about this engine if the full particulars had been given at the time the evidence of its weight was brought under the attention of this Commission. It was a tank engine that was introduced into this Colony in a surreptitious and unauthorised way, and the officer who was responsible for its introduction was removed from the Railway service for his misconduct partly in connection with this matter.

4189. *Mr. Hoyle.*] They were I understand condemned on account of their excessive weight, which was I understand destructive to the road? Yes.

4190. There is another matter upon which I should like to ask a question,—you will remember, when Mr. Midelton was in the box, certain things were said to him that I thought ought not to be said, and I should like to ask Mr. Goodchap a question relative to this in justice to Mr. Midelton.

4191. *Mr. Goodchap.*] I think you had better not ask me the question.

4192. *President.*] Let us hear what the question is.

4193. *Mr. Hoyle.*] When Mr. Midelton was in your service did you find him an efficient officer? I found him

him in some respects a most inefficient officer, with regard to the two actions I took in reference to him I can only say that if the circumstances occurred again I should pursue a precisely similar course, I should dismiss him from the position he held for reasons not altogether concerned with his qualification as an engineer, and I should install him in the position to which he was afterwards promoted for adequate reasons, not that I believe he was the most efficient officer that could be found, but because he was the most efficient officer I could find at that particular time.

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4194. *President.*] I should like to know exactly about that. When you first found it necessary to move Mr. Midelton what was his position then? He was an assistant to Mr. Scott.

4195. What was Mr. Scott? Locomotive Engineer.

4196. And when you found it necessary to take this step you re-appointed Mr. Midelton to some other position, what position was that? That was the position that Mr. Scott had held, that gentleman resigned and I had to make provision for a Locomotive Engineer, I had only two officers to choose from, and I selected Mr. Midelton as the better of the two. He had been assistant to Mr. Scott when his removal occurred, that was when he was Assistant Locomotive Engineer, I removed him and afterwards appointed him as Locomotive Engineer.

4197. Having only two persons to choose from? Yes.

4198. *Mr. Brown.*] He was under suspension? Yes, but I do not think it was for a long period, he was made Superintendent of the tramways.

4199. *Professor Warren.*] That was a better position than that which he held under Mr. Scott? I do not know.

4200. He said it was? I found his chief fault was an indisposition to work with Mr. Scott, and he was disorganising the department, and although he was a very good Mechanical Engineer he was not efficient to fill any position under a man above him whose office he was seeking, and for that reason and for other reasons I thought it was desirable that he should be removed from the position of Assistant Locomotive Engineer.

4201. *President.*] You have stated about the heavy tank engines, that they were a condemned type. With a knowledge of that class of engine in your mind are you prepared to say that the present Baldwin engines driven at the rate of 40 miles an hour, over a straight level road are too heavy for the permanent way of this Colony; I mean, looking at their weight and speed? No: always provided the roads are well sleepered and in good order.

4202. *Professor Warren.*] Yes; presuming that, of course.

4203. *President.*] And having that knowledge of the engine and the road in your mind, will you say that the goods engines going at the rate of 18 miles an hour are not too heavy? No; I do not think so.

4204. And the passenger-engines going down the grades and round the curves at 25 miles an hour? I do not think so.

4205. *Professor Warren.*] What is the minimum weight of the iron rails—(to Mr. Fehon)?

4206. *Mr. Fehon.*] Seventy-five lb., I think.

4207. *Professor Warren.*] I thought it was 71 lb.

4208. *President.*] That is the weight of the steel rail.

4209. *Mr. Fehon* (to Witness.)] The tank engine you speak of was a six-wheeled rigid base; is it the fact of the six wheels being rigid that made the engine knock the road about? They had a bogie, I think.

4210. No; they were six-wheeled rigid base. Would not that, in your opinion, cause the road to be knocked about? Yes; it would do very considerable harm; a rigid wheel-base does assist in knocking a road about.

4211. Going at 35 miles an hour, which the suburban lines are required to do—travelling at that rate with a rigid wheel-base, would it not tend to knock the road about? Yes; it might have that effect.

4212. *Professor Warren.*] When you are answering questions with regard to the safety of the Baldwin engine on the permanent way, you are thinking of the 75-lb. iron rails, and the 71-lb. steel rails, I presume? Yes; but I do not think they are equivalent; I think the 71-lb. steel rail is better than the 75-lb. iron rail; the equivalent would be about 15 lb. more.

4213. *President.*] That is to say the iron rail ought to be 86 lb.? Yes.

4214. *Professor Warren.*] So that the iron rails is the weak point. We understand if the road is in as good order as when you were Commissioner, with the speed and the weight of the engine—I refer to the Baldwin engines—would not be unsuitable to the permanent way of New South Wales? No, I do not think they would.

4215. *Mr. Hoyle.*] These tank engines were the four-wheeled coupled? With a bogie at one end, I think.

4216. With a four-wheeled bogie in front, and with a 7 ft. 4 in. rigid wheel-base? Yes.

4217. Was it the wheel-base or the weight of the engine that was doing the destruction to the roads? I think it was the weight. No doubt the rigid wheel-base would contribute in some degree.

4218. *Professor Warren.*] That engine is a two-wheeled coupled with a bogie in front? Yes.

4219. I believe that engine is the one that they designed the cross-girders of the bridges for?

4220. *Mr. Hoyle.*] That is one having the same weight, and doing the same work? Yes.

Mr. Cowdery being recalled, and further examined:—

4221. *Mr. Hoyle.*] When Mr. Cowdery was giving evidence before, he wanted certain information about the wheel-base and the weights of the engine, &c., now that information has been supplied to him I desire to ask him whether he considers these engines to be safe on the permanent way of the Colony, taking into consideration the iron rails upon the road.

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4222. *Mr. Brown.*] Have you the information Mr. Hoyle furnished you with? Yes; I have not written my opinion; but I will answer the questions he asks me.

4223. *President* (to Mr. Hoyle.)] What do you want from him?

4224. *Mr. Hoyle.*] What I ask Mr. Cowdery is this, taking into consideration the state of the roads and weight of the rails, do you consider it safe for the Baldwin engines to travel over our permanent way, when I asked this question before you said you had not the weight of the engines, and you could not give an answer at that time, I have since given you the weight, and now with a knowledge of them in your possession, and taking into consideration the state of the roads and bridges, do you consider it safe for these

Mr. Cowdery. these engines—I mean the Baldwin passenger engines, travelling at 40 miles on the straight road, and 25 miles on the curves and grades, and the Consolidation goods engine travelling at eighteen miles an hour—do you consider then it is safe for our permanent-way?

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4224½. *President.*] Forty miles an hour is the speed on a straight level road?

4225. *Witness.*] I have taken it on the base of an extreme case on the Mountains at a rate of say, 25 miles an hour.

4226. *President.*] Well, what is your opinion? I do not say that they are not sufficiently strong vertically on the sharp curves of the Mountains; but I think the greatest danger is to be looked for from the lateral pressure, or knocking or bumping against them, particularly on entering curves.

4227. What would be the effect then;—would the rails be shoved on one side? Yes; shoved on one side or broken, as it very often happens, as I daresay three out of four or four out of five are broken going round the curves.

4228. Then do you say that the engines are unsuitable to the permanent way? I say that they are unsuitable to the road laid originally by Mr. Whitton. The engines at that time were very little more than half the weight that they are now, and unless the rails had been very much increased beyond what was then required, they must be very much under weight now, and besides that, there are a great many more rails broken now.

4229. *Mr. Brown.*] Then, are these engines suitable or unsuitable to the permanent-way of New South Wales? Well, I do not think any man can settle that.

4230. *Professor Warren.*] But you are called as an expert;—what is your opinion? My experience is that the rails are too light for the engines.

4231. *Mr. Brown.*] Or that the engines are too heavy for the rails? It is the same thing.

4232. *Professor Warren.*] Do you consider that the Baldwin passenger engine, having regard to the 15 tons 9 cwt. on the driving-wheel is too heavy for the 75-lb. iron rail? I do not say it is too heavy for the vertical pressure, because we have heavier engines on the lines—but not running over the Mountains, not running any distance from Sydney.

4233. Do you consider it safe, then, with a 71-lb. steel rail? Well, I think they are quite light enough for these long based engines running at the speeds they do. When the roads were originally laid down they were laid down for a much less speed and a lighter engine, and the practice in England is that when they commence running heavier engines at a greater speed, to increase the weight of the rails, and in America also they increase the weight of the rails wherever they put these large engines, and also they put much more timber under the rails than we do here.

4234. *President.*] Where do you say they do that? In America.

4235. *Professor Warren.*] Timbers are placed much more closely there than here, timber being cheaper in America than it is here.

4236. *Witness.*] I produce a sketch of a section of one of the rails on the Philadelphia and Reading Railway. [*Sketch produced.*]

4237. *Professor Warren.*] Then you consider that these rails are weak laterally? I do.

4238. *Mr. Hoyle.*] You were engineer for existing lines under Mr. Goodchap? Yes.

4239. Do you know if any of your officers at any time reported that the American engine—the Consolidation engine, the 75-ton engine—were injurious to the permanent-way? Yes, frequently. They frequently told me verbally. I frequently went over my own work, and the inspectors and gangers told me that these engines were knocking the road all to pieces when they came out; and at the entrance to the curves they had to strut the rails.

4240. *President.*] What do you mean by strutting? Putting logs from the sides of a cutting to the edge of the rail or end of sleepers, which ever was most convenient.

4241. To keep the rails in position? Yes.

4242. *Mr. Hoyle.*] Well, as these engines were only 75 tons in weight, and the Baldwins are 90 tons, do you consider that the latter are doing more damage than the ones you have just spoken of? Well, yes; the tendency is to do so, but I do not know the result of these engines running upon the lines, because I have not had anything to do with the roads since they have been imported; but the tendency, of course, would be to increase the damage to them.

4243. Do you think the wheel base of the engines would have anything to do with that? Yes; a great deal. The length of the wheel base has a great deal to do with it; but at the same time, there is a great weight thrown on the bogies, and when they come off a straight line into these curves the centrifugal force must push the road out unless you secure it by struts.

4244. Does that endanger the rails? Yes; it not only endangers the rails but damages the road, and the road, unless kept in place by these struts, would be forced out, and the engines would, in running round the curves, perhaps run off the road.

4245. So that there ought, with these engines, to be more care and supervision with regard to the roads? I do not think any amount of care or supervision would prevent it unless by strutting the roads. I know that when some of these Baldwins first came out they shoved the roads out of line, particularly round the curves; that is a proof that the force was very considerable.

4246. *President.*] That refers to the Baldwin engines ordered when you were there? Yes.

4247. *Professor Warren.*] The 75 tons engine? Yes. I do not know anything about the present Baldwin engines except by hearing of them.

4248. *Mr. Hoyle.*] Are you referring to the Consolidation engine or the 304 class, generally known as Midelton's? I could not tell you the difference, but I know the first American engine that came out that complaint was made to me as I have stated. (*Diagram shown to witness.*) Yes, that is the old Consolidation engine to which I refer.

4249. *Mr. Hoyle.*] The rigid wheel base is, I think.

4250. *Professor Warren.*] Perhaps you can give it me.

4251. *Mr. Hoyle.*] It is 14 feet 9 inches.

4252. *Witness.*] That cannot be the engine I am speaking of. The wheel base of the engine I am referring to was, I think, about 20 or 22 feet.

4253. *Professor Warren.*] No; the base is 14 feet 9 inches.

4254. *Witness.*] The great length of these engines running round these curves knock the lines out of place, and we had to strut them.

4255. *Mr. Hoyle.*] Well, if the old Consolidation engine knocked the lines out, these new engines with a rigid base of 14 feet 3 inches must knock the road about more? Yes.
4256. *Professor Warren.*] You are speaking of the new Consolidation goods engine now? Yes.
4257. *Mr. Hoyle.*] With regard to the Board of Trade rule, do you consider that these engines running over the Solitary Creek bridges would be perfectly safe? The speed makes very little difference over a straight road like that; but I think the cross-girders of the Penrith bridge were not too strong.
4258. *Professor Warren.*] Does not that apply to all bridges included in the report? In the original report it is shown that they are weak—the main girders are strong enough.
4259. Do you think that the Solitary Creek bridge, which, according to this report, is stressed with 6·75 tons in tension, would be strong enough? Well, that is in excess of the Board of Trade rules.
4260. If this Solitary Creek bridge, which was tested with the Consolidation engine, and the calculations here show that the stress is 6·75 tons in tension;—do you think that the new Consolidation engine will make the tension more than 8 tons, and would that be safe? I should think it would be.
4261. *Mr. Hoyle.*] Was that safe? No; I do not think so.
4262. *Professor Warren.*] Neither was the first, and the second makes it still less so.
4263. *Mr. Hoyle.*] Were these bridges strengthened in the cross-girders in 1888? No; not to my knowledge. That is the Penrith bridge and the Solitary Creek bridges. There has been very little done to them since the Commission sat.
4264. *Professor Warren.*] They were for your consideration, but you did not think it worth while to strengthen them? No; it was not left to me. I should have done a great deal more to them if it had been left to me. Indeed, that was the reason of the Royal Commission—I wanted to do more to them than was thought advisable by others.
4265. The Royal Commission, in its report, says there were 9 tons on the cross-girders of these bridges? That is too much.
4266. Yes.
4267. *Mr. Hoyle.*] Did you receive any written complaint of the roads from your inspectors or gangers? I do not remember; but I am perfectly sure I could bring men, and telegraph for them, who have stated to me that they could not keep these roads in order, on account of the engines knocking them about so.
4268. Have you seen the broken rail from the Tarana accident? No; I have not.
4269. It is here? Then I should like to see it [*here the witness inspected the rail*].
4270. Having seen the rail, can you tell us whether it is a lateral strain that broke it;—could you form an opinion? I do not think I could form an opinion from that inspection of it. It might be either the weight on it or not.
4271. *Professor Warren.*] The vertical weight must have acted until it left the rails, and if there was any lateral pressure that would probably add to it? Yes.
4272. There would be the resulting pressure due to both forces? Yes.
4273. *Mr. Hoyle.*] You know the weight of the engine;—well, if the weight of the engine did not break the rail, do you think that the weight on the carriage wheel would break it? I have no faith whatever in the carriage having broken the rail.
4274. *President.*] Well, how would you account for the engine and the first carriages passing over before anything left the track? Well, that is very often the case. I have known several trains go over a broken rail before any damage was done; in fact, I have known no damage at all to be done, and yet the rail to be fractured. An old inspector of mine, who has retired from the service, and whom I met the other day, told me of a case which he knew of as happening at a place beyond Glen Innes, going down towards the Border. The driver reported to him that a rail was broken, and told him as nearly as possible about the place; he walked the ground all over, up and down, and a ganger on the length also went over it and yet neither of them could find the fracture. He talked with the driver again, and told him to throw off a big piece of coal at the place where he found the engine jump. He did so, and yet they could not find it. Finally, the driver pointed out the place as he passed, and the ganger sat down at it, and the inspector then saw the cause of the jump, and he said it was almost necessary to take a microscope to see where the fracture had happened. It had come together in exactly the same place, and there was only a fine hair line to indicate where the rail was broken. There was only one crack, and the sleepers on either side kept the rail in place.
4275. *Professor Warren.*] What about your lateral strain? Well, if this was on a curve it must have been on a very little one; it could not have been an 8 or 10 chain curve.
4276. *Mr. Hoyle.*] Do you know on what line that happened? No, I do not. I only happened to see my informant yesterday. He was in town from Newcastle. I suppose there are hundreds of rails broken to one accident that happens through such breakages. It depends entirely upon how the rail breaks.
4277. Are rails more likely to break in cold weather or hot weather? Yes; they are more likely to break in cold weather.
4278. And especially frosty weather? Yes. They creep in the hot weather, and there is a great tension on them—they are strained; in a mile of road down a long incline the hanging on the fish-bolts will be very tight indeed, and in such a condition they would be more likely to break if they got a blow.
4279. Will iron creep more than steel in a given space? I do not think there is much difference in that. Very little, if any.
4280. *Mr. Fehon.*] Are you a member of the Institute of Civil Engineers? I am not.
4281. You say that you consider that these engines are not suited to the road because they are so heavy? Yes; but that is not my whole reason.
4282. *President.*] What is the whole reason? I say the great length—that also is a reason.
4283. *Mr. Fehon.*] Are you not aware that it is the weight on the driving-wheel that governs the safety of an engine on the road? Not altogether. I stated that before, and I think I gave my reasons.
4284. Why is it so—I am speaking of safety? The lateral pressure on the rails going round sharp curves—that is the side pressure—is very much more likely to break the rail than the vertical pressure.
4285. Which do you consider would do most harm to the road,—an engine of the weight of the Baldwin engine, or two engines coupled together? The one engine certainly will knock the road more about than the two, if they are lighter engines.

- Mr. Cowdery. 4286. Do you know what was the heaviest weight on the driving-wheel when you were in charge of the existing lines? I do not know; but they were considerably less than now.
- 10 May, 1892. 4287. Will you be surprised to hear that the weight was a ton more—it was 16 tons 6 cwt.—and these are only 15 tons 7 cwt.? Oh, yes; I know that is the tank engines, and they were very much too heavy; they were not favourites of mine. One jumped off at Newtown. We had a Wade engine; I objected to her; her driving-wheels were too heavy for the leading-wheels.
4288. Was it not the bad state of the permanent way? No; I object to that. Other engines passed over the road, and it was not on account of the road.
4289. After a fall of rain did the mud squirt out from under the rail? Well, so it will from under the English roads.
4290. Will it do so on the permanent road now? It will in some places.
4291. Will it at Newtown? No, because it is now heavily ballasted; I will go in myself for all matters such as the increase of rails and ballasting of roads. I never objected to that.
4292. What was the weight of the rail in your time? Seventy-five-pound iron rail, but a good deal of road was afterwards laid with steel that was renewed.
4293. Suburban road was the same as the main road now, as far as the 75-lb. rails were concerned? Yes; I believe so.
4294. And you consider it safe for these tank engines to run on that rail? I never said that; they were only tank engines, and never went far beyond Sydney.
4295. How many years were these running? I cannot say; I cannot tell you.
4296. Mr. Brown.] You did not like them—they were running too long for you? No; I did not like them.
4297. Mr. Fehon.] You say that in America they have the sleepers placed more closely together;—have you ever been in America? No.
4298. Then you do not know this of your own knowledge? No; I do not know myself, but I have read it.
4299. Do you consider a T rail stronger than a double-headed rail? Yes; I say that a T rail is stronger laterally than a double-headed rail.
4300. Are you not a patentee of the hydra-headed rail? Yes.
4301. What became of it? You pulled it up before it was necessary; it was not pulled up on account of the chair, but because the sleeper was too weak for it. I admit, that although it was my own sleeper; but that rail never cracked, and a safer one you could not have.
4302. Professor Warren.] The deflection of the sleepers caused the rails to come together? Yes; it was through the outer end of the sleeper lifting.
4303. Suppose, Mr. Cowdery, that the gauge was altered from 4 feet 8½ inches to 4 feet 7½ inches? Oh, it was not affected that much—that is 1 inch. I think it was only affected about the sixth of an inch.
4304. But I am sure of it? But you did not find that.
4305. Yes I did; I measured it.
4306. Mr. Fehon.] Did you not find the American engines more pliable than the English? That depends whether they have bogie frames on them or not.
4307. The American engines have bogie frames on them? Some of the English have also.
4308. Is not the American engine pliable, and less likely to knock a road about than the English? My experience is that the American engine will knock the road about a great deal more, as I have stated before, and I know that has been the condition on the mountains; the men could not keep the road in repair.
4309. Speaking about broken rails, you have seen a good many broken and with cracks during the time that you had charge? Yes, latterly, a good many.
4310. And from what causes did they break? I do not know.
4311. Well, they did not break from the Baldwin engines running over them? I could not tell you whether any engine caused a fracture.
4312. But not the present Baldwin engines? I do not know anything about them. I kept away from them on purpose.
4313. President.] Why? Well, because I did not want to give evidence about them.
4314. Mr. Brown.] You did not keep out of it? No; so it appears.
4315. Mr. Fehon.] Mr. Cowdery, will you tell me how you would calculate a strain on a bridge? No, I will not; I shall not answer you a question like that.
4316. But can you? I suppose I can; I have done so before.
4317. Mr. Hoyle.] I think the question is insulting, and should not be put? (Witness :) No; I do not think Mr. Fehon means it in that way.
4318. Mr. Fehon.] No; of course I do not.
4319. Witness.] I could work it out for you; but I could not do it on the rough.
4320. Could you not tell us roughly? No, I do not intend to tell you roughly; if you want me to do it, I will do it.
4321. You have seen the rail—what do you think of it? I do not think it was a good one; it was crystallized. It is done. I dare say it has been a good one once.
4322. Do you not think it fit for the roads? Oh; I dare say it is as good as the ordinary run.
4323. What test should it take; how many feet falling per ton should that rail stand before breaking; I mean taking the drop test? I do not know how many tons that should stand.
4324. How many do you think; how many tons falling per foot should that rail stand before breaking? I do not know per foot.
4325. How many feet ought one ton fall before it broke this rail? I could not tell you from memory; I have not made any calculation.
4326. Mr. Fehon.] There is no calculation about it? My memory is not good enough for that.
4327. But your memory is good enough for many things? Yes, it is.
4328. President.] You would not care to commit yourself to an answer? No, I would not.
4329. When you were Engineer for Existing Lines did you make any recommendation for the quadruplication of the line from Sydney to Granville? Yes, certainly.
4330. It was recommended in your time? Yes.

Mr. Cowdery.

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4331. Did you make any calculations? Yes, a rough calculation, simply a plan.

4332. What are you alluding to now, Mr. Hoyle?

4333. *Mr. Hoyle.*] I want to get to the platforms.

4334. (To Witness.) Did you also recommend the alteration of certain curves on the mountains? Yes, certainly, lots of them.

4335. If you knew at the time of the quadruplication of the line that certain platforms would have to be demolished in order to carry out such quadruplication, would you have put those platforms in gauge before quadruplicating the line I mean, and provided there was no danger to passing rolling stock? I would not consider it worth while.

4336. *Mr. Brown.*] I do not think anybody else would.

4337. *Mr. Fehon.*] There was a standard gauge fixed for the platforms and tunnels when you were in office. What was the gauge of the double-road tunnel—what was the width of it? I could not tell you from memory what the width of the tunnel was.

4338. Can you tell us what was the width of the single-road tunnel? I think it was about 15 feet in the widest place, but they have curved sides, and I do not know which part you would take.

4339. Can you tell me what was the height of the platform? I think it was 2 feet 9 inches.

4340. And what was the width from the centre of the road to the edge of the platform? Of what time are you speaking?

4341. Mr. Whitton's last standard gauge? I do not think he made a standard gauge; I think we made it for him. I think it was 2 feet 5 inches from the coping of the platform to the outside of the rail.

4342. What was it to the centre of the road? We never took it from the centre; it was from the inside of the nearest rail we took it.

4343. At all events the platform had to be 2 feet 9 inches high, and 5 feet from the centre of the road to the edge of the platform? Yes, I daresay that would not be far away; what I have stated was the way it was measured for Mr. Whitton's standard gauge. I can assure you that it was so, because I have put up many platforms for him.

4344. *Professor Warren.*] Taking it at $2\frac{1}{2}$ feet?

4345. *Mr. Fehon.*] As a matter of fact it is 5 feet.

4346. *Mr. Brown.*] That is what we understood as the uniform gauge.

4347. *Mr. Fehon.*] Do you remember putting up the Rocky Ponds platform? No.

4348. Do you remember the North Menangle platform? Yes, I remember the latter; it was a short little platform, and it was put up before I was Engineer for Existing Lines.

4349. It was in your time the North Menangle platform was 5 feet $4\frac{3}{4}$ inches from the centre of the road and 2 feet $10\frac{3}{4}$ inches high? I did not put that up.

4350. Do you say that you did not put up the North Menangle one? No.

4351. Did you put up the Douglas Park platform? No.

4352. The Maldon platform? I do not know where it is.

4353. *Mr. Brown.*] Can you remember any you put up? Yes, Mittagong.

4354. *Mr. Fehon.*] Do you remember Galgong platform? No, I do not remember.

4355. I think we can give evidence to show that Mr. Cowdery put up all these platforms, and that they were out of gauge.

4356. *Mr. Brown.*] Perhaps the foot rule was not the same length as it is now.

4357. *Witness.*] There was never a platform put up without the drawings being made out and figured in.

4358. *Mr. Fehon.*] You did put up the Arncliffe platform? No; Mr. Whitton did that.

4359. Did you alter the gauge of that? When the first Baldwin engines came out to this Colony we had to reduce some of the platforms to allow them to pass.

4360. Oh, you had to do that in your day? Yes; or in Mr. Mason's.

4361. How many did you alter to make room for these engines? Some of them we did not alter.

4362. But how many altogether? Not many.

4363. Thirty or forty? Not so many as that. We altered the roads in some places, and in some places I think we could scarcely have the 6 feet between them, which I do not say is the correct thing. We could not have a uniform gauge.

4364. *Professor Warren.*] Certainly, you could not have a uniform gauge, when you had to alter some platforms and not others? When these engines first came out they were to run only on the Western line, and we altered all the platforms there. Then again, a good deal depended upon whether they were on the curves, as the long vehicles made a great difference.

4365. And these Baldwins were not allowed to run on the Northern line you say? They were only required on the western lines.

4366. So that if the present Baldwins were required to run on the Northern and Southern lines, and since they are larger than the old Baldwins, the platforms on the Northern and Southern lines would require to be altered? Yes, certainly.

4367. And the platforms would have to be altered for the old Baldwins if they run on the Northern and Southern lines? Yes, I daresay they should. I do not see why they should not.

4368. *Mr. Hoyle.*] There are some of the witnesses here whom I have called—the drivers on some of the engines, and though it may perhaps be a serious inconvenience to the Department to have them remain down here to night, still for certain reasons I cannot call them this afternoon. I do not like to put the Commission to inconvenience, but for certain reasons I cannot call them now, and I would ask the Commission to allow their evidence to stand over till to-morrow.

4369. *Mr. Fehon.*] It is most inconvenient to keep these four drivers away. They are running on the same road, and it is a very serious for these men with their regular trains to drive and their regular duties to perform. They cannot go to Bathurst to night and return here by to-morrow.

4370. *President.*] But still Mr. Hoyle might have some very strong reasons.

4371. *Mr. Hoyle.*] I have very strong reasons indeed.

4372. *President.*] I am quite sure of this that Mr. Hoyle would not ask for the postponement of this evidence unless he had some reason that appears very strong to himself. I do not for a moment suppose that he would willingly put the Department to inconvenience.

4373. *Mr. Brown.*] I think that on the other hand he has manifested throughout this inquiry a desire not to put the Department to any inconvenience.

4374. *Mr. Hoyle.*] I would not ask what I do but for very strong reasons indeed.

4375.

Mr. Cowdery. 4375. *President.*] You might consider the matter Mr. Hoyle whilst the next witness is under examination. Will he take long? Yes, I think he will, there are a great many questions I want to ask him

10 May, 1892. 4376. However inconvenient it will be I cannot help that, and I do not think for one moment that Mr. Hoyle would willingly put the Department to any inconvenience, although as a matter of fact, I do not see how I can help it under any circumstances, but he has some strong reason you may depend upon it.

James Isaac Haycroft, being sworn, said:—

Mr. 4377. I am a civil engineer.

J.I. Haycroft. 4378. *President.*] What are your qualifications. Are you a member of the Institute of Civil Engineers? I am a corporate member, I am also a Master in Engineering of the Queen's University, Ireland.

10 May, 1892. 4379. Have you been connected with any railway service in the old country? Yes.

4380. Where is that, in Ireland or England? England.

4381. With what line? The Great Western, London, North-western, and the South-eastern.

4382. In what capacity? Well I was assistant to a firm of civil engineers. I was with Mr. Wells Owen, son of the chief engineer on the Great-western railway, and through his good offices I had introductions to the chief engineers on these various lines, and they gave me *carte blanche* to make inspections for myself.

4383. But have you been engaged upon any of these lines in the capacity of an engineer to a railway company? Yes, on the Hounslow and Metropolitan Railway and also upon a branch line to the Great Western Railway at Bridgewater.

4384. What was your duty on these lines? I was engaged in constructing the permanent ways on the Hounslow and Metropolitan Railway.

4385. *Professor Warren.*] Did I understand you to say that you were a member of the Institute of Civil Engineers? I am a corporate member.

4386. An associate member—it is usual to state that? It is a matter of taste.

4387. Yes, but people differ as to matters of taste.

4388. *Mr. Hoyle.*] You have had considerable experience on the English railways? Yes.

4389. On the English railways you have to take into consideration the strength of the rails? Yes.

4390. And when you are taking into consideration the strength of the rails do you not also take into consideration the weight of the engines that have to run along them? Not exactly the weight of the engines, but the weight on the driving-wheel.

4391. You also have had experience with regard to the difference in the sleepers? Yes.

4392. Do you know the weight of the Baldwin engines? Not personally, but I have heard the weight stated in the course of evidence.

4393. You have read the evidence that has been given before the Commission in the daily papers, I suppose? Yes, and I have heard some of it.

4394. You may have heard to-day if you have been in the room that the weight on the driving-wheels of the Baldwin passenger locomotive is 15 tons 6 cwt., and that the weight on the driving-wheels of the Baldwin Consolidation engines is 15 tons 9 cwt.? Yes.

4395. And that the passenger engine is to travel 40 miles an hour on a straight road and 25 miles an hour on curves, and that the Consolidation engine is limited to a speed of 18 miles an hour all round? Yes.

4396. I want to ask you to give us your opinion as a railway engineer as to the suitability or otherwise of our permanent ways with an iron rail weighing 75 lb. to the yard, and a steel weighing 71 lb. to the yard for these two classes of engines. I want to ask you whether taking the weights of these two rails into consideration, and taking into consideration also the weights of these engines on the parts named, do you consider that they may be run with safety over our roads? I can only give you an opinion with regard to the iron rail, which I have investigated, and that is, that the weight of a Baldwin engine upon it is excessive. I have not examined the steel rail, but judging from analogy I might be able to give an opinion.

4397. *President.*] What is the weight of the iron rail? Seventy-five pounds to the yard.

4398. And you say that the weight of the engine is excessive for that rail? Yes.

4399. *Mr. Hoyle.*] Would you kindly give the Commission the result of your investigation. You have had a sketch of a section of the rail, I believe? Yes, I have.

4400. And you have investigated the matter from that sketch? Yes, from the sketch supplied by the Department for Railway Construction; and though I am sure it has not been wilfully done, still the sketch is not to scale although it is full size. However, upon seeing that sketch I have come to certain conclusions which amount to this, that with the chairs 3 feet apart, or in other words, with the centre bearings of the rail 3 feet apart, the stress in the case of a Baldwin engine with 15 tons 9 cwt. on the driving-axle would amount to 5.18 tons per square inch, and with the chairs, 2 ft. 3 in. apart centres.

4401. *Professor Warren.*] Do you mean the sleepers? Not exactly the sleepers, which, of course, are approximately the same distance apart themselves, but the chairs placed in the centre of the sleepers. I say that, with the chairs 2 feet 3 inches apart in the case of a Baldwin engine with 15 tons 9 cwt. on the driving-axle, the stress on the fibres of the rail would equal 3.88 tons. Those may seem small figures to the non-professional mind, but when it is remembered that the working stress on a rail is much less than in any other kind of ironwork, it will be seen that they are by no means unimportant. It has been found from recent investigations by German scientists that ultimate strength of a structure such as a rail is 13.38 tons per square inch, and that the ultimate strength of steel is 21 tons per square inch. Adopting a factor of safety of 3, the allowable stress on an iron rail should not exceed 4.46 tons per square inch, and adopting a factor safety of 3, the allowable stress on a steel rail should not exceed 7 tons to the square inch. As a matter of fact, 3 is a rather low factor of safety for a rail. It should be increased to at least 4, due to the direct impact of the load on the rail, and if 4 is adopted as a factor of safety, the allowable stress in an iron rail then becomes 3 $\frac{1}{2}$ tons to a square inch, and the allowable stress in a case of a steel rail becomes 5.25 tons to a square inch.

4402. Might I ask how you arrive at these figures? In the ordinary way any professional man would arrive at them.

4403. Yes, but that is hardly definite enough. How did you, as a professional man, arrive at them? By investigating them.

4404. *President.*] How did you investigate them? By getting the maximum bending moment due to the load on the driving-axle.

4405. *Professor Warren.*] Where is the maximum bending moment? On the centres between the chairs.

4406. Then I understand you to say that you took it just as if the rails were cut off at the chairs? No.

4407. Then how did you do it? I treated it as a continuous girder, and as a girder which was firmly fixed at the ends.

4408. You took it as a continuous girder, and yet you say that the maximum bending moment was at the centre between the chairs? No; I never said so.

4409. You said in the first instance that your maximum bending moment occurred between the chairs; now you say you took it as a continuous girder, and the maximum bending moment occurred elsewhere. Where was that? I forget for the moment, as I have not the investigations with me.

4410. But where would it occur? Over the piers.

4411. On what assumption is the continuous girder theory founded? On a principle which cannot exist in the case of sleepers—namely, that the supports are rigid and in one plane.

4412. You cannot adopt the continuous theory. In the case of a rail on sleepers you should take it as a beam firmly fixed at the ends, and even then you are arguing in favor of the heavy weight that comes on the rail.

4413. You say you took that as a close beam, and the maximum moment was in the centre? Yes; the span is divided into three parts. The central span was half the length, the load being supported midway between the chairs.

4414. Where are the points of inflexion? Nine inches. That would give 36 inches between the centres, and a central span of 18 inches. Then of course you allow, as it is usual in good practice, a percentage for the dynamic effect on the rail. I allow 33 per cent. Some engineers go as high as 50 per cent., but 33 per cent. is ample.

4415. That is to say, you first of all assume the rail is a fixed beam, and then you allow for your load by adding 33 per cent. to it, or in other words you increase your bending moment by 33 per cent.? No; get the stress due to the bending moment on a fixed beam, and add the percentage to that. That would be the course if it were a quiescent load, but the dynamic effect of a load is 33 per cent. more.

4416. And you consider that to be good practice? Yes; because that has been found to be the proper mode to design iron subject to treatment such as an iron rail or the lattice in a girder receives from a live load.

4417. Whose experiments are you quoting? I believe this is the opinion of Wohler, Weyrauch, and Bauschinger. I then investigated the effect of the engine in use before the Baldwin engines arrived. That engine belongs to the 265 class, weighs 63 tons 16 cwt., and has on the driving-wheel a weight of 13 tons 13 cwt. With chairs 3 ft. apart the stress caused by it on the fibres of the rail would equal 4.57 tons per square inch, and the same engine with chairs 2 ft. 3 in. apart would cause a stress on the fibres of the rail equal to 3.3 tons per square inch.

4418. *Mr. Fehon.*] Which engine is that? An engine belonging to the 265 class.

4419. Is that a Mogul engine? I do not know. It is called the Express, 265 class. I may say that I got these weights from the report of the Royal Commission on Bridges.

4420. If you are speaking of the Mogul engine you are quite wrong? It is what is known as the 265 class in the report of the Commission on Bridges. It has an exceptionally heavy load on the driving-axes considering the weight of the engine.

4421. *Professor Warren.*] Yes: that is right. It has a load of 13 tons 13 cwt. on the driving axes.

4422. *Witness.*] I found on investigating that engine that the stress on the rails amounted to 4.57 tons per square inch, with the chairs 3 feet apart, and that the same engine with chairs 2 feet 3 inches apart would cause a stress on the fibres of the rail equal to 3.3 tons per square inch. Then, with regard to the Consolidation goods engine, weighing 75 tons 3 cwt. 1 qr., and 9 tons 15 cwt. on the axle, I find that the stress in the fibres of the rail with chairs 3 feet apart equal to 3.27 tons per square inch, and with chairs 2 feet 3 inches apart centres, the stress would amount to 2.45 tons per square inch. One thing in an investigation of this sort which is bound to be taken into consideration is the fact that, although the primary investigation could be taken as between a maximum of 3 feet bearings, one sleeper may not be properly packed, and thus give no support to the engine, in which case the 3 feet bearings would be increased to a 6 feet bearing, and then if the Commission wished I could give them the stress with which a Baldwin engine and other engines would strain the rail. As a matter of fact, the strain would run very nearly to the ultimate strength of the iron.

4423. *Professor Warren.*] You mean that by doubling the span you double the strain? Yes; it is an allowable case.

4424. But do you consider that treating a rail as a fixed beam is fair? Yes; when it is the only way in which you could arrive at the strength of it—when you have to throw overboard the rigid theory of the continuous beam, and it is certainly in favour of the weight resting on the rail.

4425. You mean to say? That the strength is increased by that supposition. If there is an error, it is on the safe side. I was going to say that in the case of the 63 ton engine, that if unsupported by one of the chairs as a result of one of the sleepers not being properly packed, the stress on the fibres of the iron would reach 9.15 tons per square inch. That is presuming the rail to be unsupported for a distance of 6 feet; but if the length of the unsupported rail equalled 4 feet 6 inches, the stress on the fibres would then reach 6.7 tons. In the case of the Consolidated goods engine No. 134, with 6 feet bearings, the stress on the rail would amount to 6.5 tons per square inch, and with 4 feet 6 inch bearings, the stress would equal 4.9 tons per square inch. Sir John Fowler's test for New South Wales double-headed rails, weighing 75 lb. per yard, are that a length of rail 4 feet 6 inches be placed on iron supports 3 feet 6 inches apart centres, and then subjected to three blows of 1 ton falling 12 feet, and that under this test it shall deflect not less than $6\frac{1}{2}$ nor more than $7\frac{1}{2}$ inches without signs of fracture.

4426. *Mr. Hoyle.*] Then having investigated the strength of the rail from very many scientific stand-points do you, Mr. Haycroft, consider that the rails are too light to carry the Baldwin engines? Well, I would not classify them as too light, I would rather classify them as not strong enough. If the 75 lb. iron rail were made of steel I should certainly not call it too light.

4427. Then do you consider that a 75 lb. iron rail is not sufficiently strong to carry these Baldwin engines? Yes; I do.

4428. That is the conclusion at which you have arrived after investigating the matter from the various scientific stand-points that you have alluded to? Yes.

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4429. I want to ask you a question now relative to bridges, I want to know whether you consider, taking into consideration the weights of the two different kinds of Baldwin engines, as already indicated, that the load per foot per ton run due to them would be safe over the Solitary Creek and Penrith bridges? Assuming certain facts, it would be unsafe, the assumption being that the bridges are in the same condition now as when their strength was investigated by Professor Warren for the Royal Commission on Bridges. According to the experiment then made by Professor Warren, unless the strength of the bridges has been increased to an even greater extent than that Commission stated would be necessary, they are too light for the Baldwin engines. I would like to qualify that by saying that because an engine goes 4,000 times across a bridge safely, it is not necessarily safe when it travels over it the four thousand and first time. We saw an instance of that recently in the case of the Monchestien bridge in Switzerland which, though badly designed, carried the traffic for several years, but ultimately collapsed without any warning, due undoubtedly to its not being strong enough when erected. I am perfectly certain, taking as facts the deductions brought to light by the Royal Commission on Bridges, that, unless steps be taken to increase its strength, the Baldwin engines running over the Solitary Creek bridge will sooner or later lead to a collapse.

4430. You may have investigated the Penrith bridge in the light of the facts adduced by the Royal Commission, and I would like you to give us your opinion of it, taking into consideration the report of the Commission and the weight of these engines? Well, the Penrith bridge was designed, and I believe is capable of carrying, with a few exceptions of rivets and bearing area of the web, a live load of $1\frac{1}{4}$ tons per foot run on each line of rails. The weight of the Baldwin engine however reaches 1.87 tons on each line of rail. That of course is very much in excess of the weight which the bridge is calculated to bear, and the only possible deduction is that the Penrith bridge is not sufficiently strong to bear the rolling load placed upon it by the Baldwin engines. The Baldwin engines place a strain of two-thirds of a ton more upon the bridge than was imposed by the test load which the members of the Bridge Commission considered it safe to carry. According to the evidence of the Commission the consolidation engines impose a stress of 14 tons on a bearing area of portion of web-plates. Whereas according to the Board of Trade Rules, $6\frac{1}{2}$ tons strain is the outside strain which should be permitted.

4431. *Professor Warren.*] There are differences of opinion on the matter. A Committee was appointed by the Institute of Mechanical Engineers, and I have no doubt you have seen a report of that Committee, on the question of rivet joints. Do you think that, taking that report into consideration, $6\frac{1}{2}$ tons is excessive on the bearing area? No, I consider it a limit.

4432. Well, supposing the stress was 8 tons on an iron rivet, do you consider that that would be excessive? It depends upon the class of treatment to which it is subjected; for instance, a rivet in a boiler should stand a greater strain than a rivet in a bridge.

4433. Taking the case of the Penrith bridge into consideration, do you consider that 8 tons is too high? Yes, in the case of any bridge I consider that 8 tons on the bearing area is too high.

4434. Are you not aware of the conclusion arrived at by the Committee appointed by the Institute of Mechanical Engineers was that the joints appeared not to be injured when the ultimate bearing pressure did not exceed 40 tons per square inch and in the case of steel 50 tons per square inch? I am not aware of it.

4435. Are you also aware of what Professor Unwin says in his text book, that he thinks too much has been made of this pressure on bearing area? I have seen his remarks quoted.

4436. And he quotes the report of the Committee appointed by the Institute of Mechanical Engineers to the effect that the joints appeared not to be injured when the ultimate bearing pressure did not exceed 40 tons per square inch in iron structures, and 50 tons per square inch in structures of steel. I am speaking of the ultimate stress of course? Oh yes, but you would have to adopt the old Board of Trade rule of reducing the working pressure down to 5 to get 8 tons on the bearing area. Of course it all depends on what the material is that the structure is made of.

4437. Have you worked out the bending moment of the Baldwin engines on the Penrith bridge? No, I have not, I have simply taken the fact that the report of the Royal Commission on Railway Bridges says that the bridge was constructed for the carrying of a live load of $1\frac{1}{4}$ tons per line of rails, whereas the test load is only 1.1. I may be right, or I may be wrong. The other point was that $1\frac{1}{4}$ tons per foot run induced the stress on the bearing area of the web plates of 14 tons, and on the rivets of 9.3 tons. In order to ensure the safety of the bridge, the Commission recommend that the $\frac{3}{4}$ -inch rivets be taken out for certain distances from the ends and 1-inch rivets substituted for them; also that the pressure on the bearing areas were larger than desirable. If that was necessary for such a small load, of course it is very much more necessary for a load such as is represented by a Baldwin engine. However unsafe the Penrith bridge may be, the Solitary Creek bridge, if in the condition it was in the year 1886, becomes now a matter for very serious consideration.

4438. What is the greatest stress you make in the Solitary bridge as the result of a Baldwin engine running over it? Treating it in the same way as you treated it on the Commission, I have found the stress on the centre of the booms to be approximately 8 tons per square inch. Whereas even under the Board of Trade Rules 5 tons is the limit and where the difference between the life load and the dead load is so marked, it should not exceed $4\frac{1}{4}$ tons.

4438 $\frac{1}{2}$. Do you think that, taking the statistical strength of the iron as 21 tons, that the breaking strength, allowing for the ratio between maximum and minimum stress, is equal to 14 tons? I really would not like to give any direct answer to that question, because, as a professional man, I object to giving anything in the nature of a guess.

4439. *Mr. Hoyle.*] With what firm did you serve your time? With B. B. Stoney, chief engineer, of the Port and Docks Board of Dublin, and celebrated as an authority on stresses. He is not a railway engineer, however, and all the railway experience I have had has been in England.

4440. Have you any knowledge of the distance which in England it is usual to place the sleepers apart? I find that the London and South-western Railway have a 82-lb. steel rail, with sleepers 2 feet 10 inches apart centres, the sleepers being the same size as those used in New South Wales, namely, 10 inches by 5 inches.

4441. *Mr. Brown.*] You said just now that you found that such was the case; do you mean that you found it from personal experience, or as the result of reading about it? Well, it was by refreshing my memory.

4442. It is not from personal experience, then? Yes; it is from personal knowledge of seven years ago, but I cannot be expected to carry all those details in my mind. The South-eastern Railway has a rail of

of 82 lb. per yard, with a distance between the sleepers of 2 feet 8 inches. That is a double-headed rail. The North-eastern Railway has 82-lb. double-headed rails, with the sleepers placed at a distance of 2 feet 9 inches apart. A non-reversible rail is used by the Midland Railway. It is 85 lb. weight to the yard, and the sleepers are 3 feet apart. The London and North-western Railway also use bull-headed rails, and they are 84 lb. per yard, with a distance between the sleepers of 3 feet 1 inch. The Great Northern Railway is laid with bull-headed rails, weighing 82 lb. per yard, and the sleepers only 2 feet 8½ inches apart. The Great Western Railway has 86 lb. bull-headed rails, with the sleepers 2 feet 9 inches apart, the sleepers in that case being 12 feet by 6 inches. The Metropolitan Railway is similarly constructed of bull-headed rails, 86 lb. to the yard, and sleepers 2 feet 9 inches apart.

4443. *President.*] But you have not been over all these railways, have you, Mr. Haycroft? I can give evidence from personal knowledge of the Great Western, the London and North-western, the South-eastern, and the Metropolitan.

4444. *Mr. Brown.*] Can you say that the rails that you have just referred to are the kind of rails they are laying now, or merely those are the kind of rails they were laying seven or eight years ago? They were laying them about seven or eight years ago, and if anything, they have increased their weight in the meantime.

4445. *President.*] Very well; you may continue, Mr. Hoyle.

4446. *Mr. Hoyle.*] Can you tell us whether these rails are laid only for the purpose of economy or to meet the strain of heavier classes of rolling stock, such as are being introduced of late years? Well, the strength of the rails has no doubt been adopted for the purpose of carrying additional weight, but the material in them is used from the point of economy. Steel is used, as being more economical than iron. The life of the steel rail might reach twenty-five years. The life of an ordinary iron rail, if it exceeds five years, it is a very good rail.

4447. That is speaking of English traffic, I suppose? Yes. I have no knowledge of colonial traffic at all.

4448. And I suppose the price of material will have something to do with that as well? Yes; steel rails were much dearer than iron rails, but economy is gained in the life of the rail.

4449. If you had to design a railway, and you had within your knowledge the fact that the Baldwin engines had to run upon the railway, would you consider it safe for these engines to run, or would you make a line with the 75-lb. iron rail? Certainly not. Not with sleepers anything over 2 feet apart. When I say sleepers, I mean chairs.

4450. Have you any experience of the weights on the driving-wheels of the engines in England? Well, I have done very little in that line. I have known cases on the Metropolitan railway in which the weight of the driving-axle has been 17½ tons, and I have heard it alluded to in the Institution as a remarkable instance of how people will dare to run abnormally heavy engines.

4451. Where did you get the knowledge with regard to the permanent way? In London. During my spare time I made it my business to study the permanent way, and that has enabled me to offer these opinions to the Commission.

4452. *Professor Warren.*] With reference to the weights on the driving-wheel, have you ever designed a railway bridge? Yes; several.

4453. And you use cross-girders in your bridges? Yes.

4454. And did you not consider the weights on the driving-wheels? In constructing a bridge you must consider the driving-wheels, because the strength of the cross-girders is regulated by the weight on the driving-wheels, and the stress of the main girders is regulated by the load per foot run. In the construction of branch lines in England, necessary information with regard to the strength of bridges and permanent way is always furnished by the company for which the branch runs, and by that means I have been made conversant with the weights on the driving-wheels allowed there.

4455. *Mr. Hoyle.*] Do you know whether the Board of Trade in England controls the strength of the bridges? Yes; they inspect them before they are opened for public traffic.

4456. Do you think, then, from the calculation of the Royal Commission on Bridges, that the Board of Trade would allow such an engine as the Baldwin engine to be used over the Solitary Creek bridge? It stands to reason that they would not, because its ultimate strength is 5 tons tension.

4457. *Professor Warren.*] Do you believe in the Board of Trade rules? I do not. I think they are not keeping up with the investigations of to-day in that respect.

4458. *Mr. Hoyle.*] Well, considering that the Board of Trade rules are out of date, let me ask you the question in this way. Do you consider that the Solitary Creek bridge is safe for the Baldwin engines to travel over? I am bound to believe that it is not. I am very sorry to have to do it, though.

4459. Can you tell us if it is the custom for the Board of Trade officers to examine all lines of railway before they are opened for traffic? It is absolutely necessary to get a certificate from the Board of Trade before you can open the lines. I have known the opening of lines delayed on that account.

4460. I have no further questions to ask at present. If additions have been made to the strength of the bridges, I should be glad for them to be submitted to the witness that I might obtain his professional opinion upon them.

4461. *President.*] You mean that supposing the Railway Commissioners say that these bridges were strengthened before these calculations were made you want to know in what respect they have been strengthened?

4462. *Professor Warren.*] Supposing Mr. Foxlee or Mr. Deane gave evidence would you be satisfied with that? —

4463. *President.*] Assuming that Mr. Fehon supplies the information now, as Mr. Hoyle suggests, it might obviate the necessity of his giving, what in a court is called, evidence in reply.

4464. *Mr. Fehon.*] There will be no gainsaying the evidence that we shall submit. It will be taken from actual facts, and will not be the opinion of any man.

4465. *Professor Warren.*] I may say that Mr. Foxlee wrote to me to-day, saying that he was going to bring certain drawings of bridges—some that you asked for, Mr. Hoyle, and some that were asked for by the Commission.

4466. *Mr. Fehon.*] How long have you been in the Colony? Six years.

4467. How long have you been an associate member of the Institute of Civil Engineers? About two years. Would you like to know why it is such a short time?

4468. I do not ask you? Well, I would like to qualify the answer. The reason that I did not become an associate before that was that when I contemplated coming to Australia I was certainly not aware

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aware that they thought so much of the fact that a man was a member of the Institute, but when I arrived here I found to my surprise that they thought more of that Institution, in which the greatest number of duffers that I know in the profession are congregated than of the University Degree, which I hold one of the highest in the United Kingdom. Learning that such was the case I became a member, as I say, two years ago. As a matter of fact I could have been a member at least ten years previously.

4469. But you are not a member now? I am a corporate member now.

4470. An associate member? Yes; one and the same thing.

4471. What occupation do you follow now? I am borough engineer at Woollahra.

4472. That is why you got your associate membership, is it? No; it certainly is not.

4473. How is it you have taken so much trouble to work out the fractions and decimals—the weight of the Baldwin engines and the effect they would, in your opinion, produce upon the rails and bridges of the Colony. How is it you have taken so much interest in the Baldwin. You came here prepared with a great amount of scientific evidence? Yes, I was asked to come and give expert evidence upon it. If I had been asked by the Commissioners to do so I would have done the same.

4474. *Mr. Brown.*] And you do not come armed with a bow and arrow, do you? No.

4475. *Mr. Fehon.*] But still I do not understand what your qualifications as a railway engineer are? I explained how I had become conversant with the different railways of England through being in Mr. Wells-Owen's office. He was the son of Mr. George Owen, of the Great Western Railway. Work being slack for a few months, and, consequently, not being required in the office, I got *carte blanche* to go over nearly all the different lines, and I confined most of my time to observations concerning the permanent way.

4476. You have given evidence concerning the weights of the bull-headed rails that were used on some of the English lines six years ago.

4477. As a matter of fact were the bull-headed rails in use at that time? Yes; I put them down myself on the Hounslow and Metropolitan Railway over nine years ago.

4478. Those were the first that were put down? I think so.

4479. Do you know what the weights of the rails on the New South Wales railways are? I heard to-day that they were 75-lb. rails when iron and 71-lb. when steel.

4480. Would you be surprised to hear that there are 110 miles of 55-lb. rails? That is on the suburban line, I believe.

4481. At all events, you are aware of the fact that in America they are running much heavier engines on much lighter rails than those used by us in this colony? No; I am not aware of it.

4482. *President.*] You have heard of Dr. Williams? Yes.

4483. Is he not a very eminent man in his profession? Yes; he is accounted eminent by his profession.

4484. Well, that is really the only way in which any professional man is accounted eminent. His abilities are approved by the members of his profession? Yes, no doubt.

4485. Well, Dr. Williams is one of the firm of the Baldwin Company? Yes; I believe he is.

4486. You would imagine that he would know what the respective weights of the engines and the permanent way in this Colony are? He should have been able, from his experience, to form a very good opinion.

4487. *Mr. Fehon.*] Are you aware that the greater number of rails in America are iron rails? Yes; I know that the American practice is very dickey.

4488. Do you know how far the sleepers are placed apart in England? Well, they are placed at different intervals on different railways.

4489. No there is a standard distance for placing sleepers? I am not aware of the standard.

4490. I am referring to the Board of Trade standard? I do not swear it, although I am on my oath, but I am under the impression that the distance apart is 2 feet 9 inches on the Board of Trade standard.

4491. You will be surprised to hear that it is 3 feet, I suppose. How long should a 75lb. iron rail last? It would depend altogether on the nature of the traffic.

4492. I understood you to say just now that it should last five years? I was speaking then as to how long it should last under ordinary traffic.

4493. What do you call ordinary traffic? Well, much more frequent than the traffic on the mountain lines?

4494. How long ought a 75-lb. rail to last, say, on the Western line at Tarana, for instance? If it was a good rail, I should not be surprised to hear that it lasted eight or ten years with a fair amount of traffic on it?

4495. Should it not last twenty years? It might.

4496. What makes an iron rail wear away? When the fibres begin to strip.

4497. So long as the top of the rail remains sound you consider it a good rail? So long as the outer surface lasts, do you consider it a sound rail? If there is no other defect in it, I do.

4498. If there is no fracture in it? And no flaw.

4499. In England, is it not the custom to allow the head to be worn to a certain depth before the rail is taken up? Yes; 10 per cent. of the weight may be taken off the head and yet the rail is safe.

4500. Do you consider that a rail, which had lost only 1 lb. and a fraction per yard would, at home, be considered a safe rail? Undoubtedly, because the ultimate strength would not be reduced at all.

4501. Have you looked at that rail? You mean the rail that was broken in the Tarana accident;—yes; I have looked at it.

4502. Do you consider that a sound rail? Barring the flaw, it is a fair rail.

4503. That rail has only lost 1 lb. and a fraction to the yard. Do you consider it a safe rail? With the exception of that flaw it is a sound rail.

4504. I will ask you a question that I asked Mr. Cowdery, and that he did not answer. Perhaps you, as a practical engineer, might answer it. What drop-test should it stand; how many feet can you drop 1 ton, or how many tons should it stand dropped 1 foot? Before answering that question, I may say that that rail was never designed to stand a drop-test at all—it was designed to be subject to a bending test. It was designed by Sir John Fowler, and, as I have already stated, Sir John Fowler's tests for New South Wales double-headed rails, weighing 75 lb. per yard, are that the length of rail, 4 feet 6 inches, be placed on iron supports 3 feet 6 inches apart, centres, and then subjected to three blows of 1 ton falling 12 feet, and that under this test it shall deflect not less than 6½ inches, nor more than 7½ inches, without signs of fracture.

4505. You say that that rail was designed by Sir John Fowler? I did not mean that particular rail. What I meant was that the double-headed 75-lb. rail was designed by Sir John Fowler, and that the test he applied to it was what I have just stated. Mr.
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4506. Well, you, as a practical man, should be able to tell how many tons that rail should stand? It should stand at least between 15 or 16 tons falling a foot, or 15 or 16 foot tons without fracture. No man can tell me what weight would fracture it until he had tried the experiment. 10 May, 1892.
4507. Not an ordinary rail like that? No; but then there are other tests that rails should be subjected to, and one of those is for the purpose of ascertaining its toughness.
4508. You say that steel rails are not used in many instances because they are dearer than iron? I am not aware of having said so.
4509. Do you know the relative value of steel and iron? No; I do not.
4510. *Mr. Brown.*] Are you quite certain that one is dearer than the other? Well, that is the impression that I gained when I made inquiries into the matter about six years ago. Of course, the market value of steel and iron may have greatly altered since then.
4511. There was a time, of course, when steel rails were dearer than iron rails, but that is not a fact now. Steel rails are really cheaper than iron rails? I am not surprised to hear it.
4512. *Mr. Fehon.*] You have not given us exactly what your railway experience has been. Would you kindly tell us how long you were in the employ of the various Railway Companies. I do not wish you to include the place at which you served your time? My length of time on the Hounslow and Metropolitan, which was the first railway I was employed upon professionally, was eight or nine months. During that time I was employed upon the extension from Ealing to Hounslow.
4513. What was your particular position there? I was one of the assistants to Mr. Wells-Owen, the Chief Engineer.
4514. And what other railways were you on in the old country? I laid out a line from Bridgewater to Highbury, on the London and South Western.
4515. And how long were you there? A matter of two months, I think; and during the greater part of six months I travelled over the other railways that I have referred to.
4516. And what other railways were you professionally connected with? Those are the only two that I have been connected with professionally, except as an observant professional man.
4517. Do you read the *Engineering News* of America? No; I cannot say that I do.
4518. Did you ever hear that the Baltimore and Ohio railway were using 86-lb. steel rails? No; I did not.
4519. *Mr. Brown.*] What process of deterioration goes on with an iron rail where the fibrous matter becomes crystallised, so as to destroy its value as a rail, and how long does it take before that is accomplished? My own opinion is that no such thing ever happens. I do not believe that the rolling load ever crystallises the fibre in a rail, no matter how long it is down. All that really happens is, judging from the texture of a rail after fracture, that a waste of the material itself takes place as the result of wear and tear. As to whether the interior of a rail appears granular or fibrous after fracture depends entirely upon the nature of the fracture itself, and in my opinion you cannot prove the crystallisation theory by it.
4520. Then you, as an engineer, state that the length of time the rail was down would not make any difference;—suppose that a rail had been laid in 1860, and that there had not been much traffic over it, is there any process known to engineering by which crystallisation, or some other process destructive to the fibrous or other nature of the rail, takes place, so as to make it in the course of time unfit for traffic? Atmospheric action is detrimental to the rail.
4521. *President.*] You mean rust? Yes.
4522. But that is not what Mr. Brown is alluding to. We all know that iron left in the open air will in the course of time become rusty. What Mr. Brown means is this: Does the structure of the rail alter? I am of opinion that it does not alter.
4523. So that, if you put rails down in 1860, and to-day those rails are still there, nothing have gone over them in the meantime—we all know of course that they would be tremendously rusty;—but would any other change have taken place? I cannot see that any other change would have taken place.
4524. *Professor Warren.*] But if they had been in use? If they had been in use in the case of a fibrous iron rail, they have stripped to some extent. They would tend to wear upon the bearing surface.
4525. *Mr. Brown.*] But, in your opinion, that is all? I am of opinion that there is no such thing as crystallisation due to working, and that a rolling load has no such effect upon a rail so as to change the material from fibres to crystals.
4526. *Professor Warren.*] You do not believe in cold crystallisation;—you do not believe in crystals being formed in metal as the result of rolling loads? No; I believe that crystals can be formed in manufacture, but not by use, if stressed within the safe limit.
4527. *Mr. Brown.*] I suppose the Commissioners will furnish some evidence with regard to that?
4528. *Witness.*] If you were to put 50 tons of rails down in a store for fifty years, they would be just as good, barring rust, at the end of that time as they are now.
4529. *President.*] Take this rail. It must have been bad from the very first, must it not? Yes; but there was an inherent flaw in it.
4530. *Professor Warren.*] Is it not a fact that Wöhler and Bauxhinger have found that if iron was tested by a stress repeated five million times, it might not break during those five million stresses but that it might break upon the next repetition of the test. How do you account for that? It is a scientific question that I would not like to express an opinion upon, but I know that an equally eminent man, Claxton Fiddler, disagrees with them on that point. Personally I have not given the question a great amount of thought.
4531. But I want to know whether it is not a fact that you can strike a piece of iron a very great number of times without fracturing it and that when you strike it again it will break? Yes; it is a fact, but I will not attempt to explain the cause of it, it is attributed to fatigue.
4532. Leaving the crystallisation theory out altogether you say that iron is just as good after it has been in use a certain number of times as when it is new, allowing for ordinary wear and tear? Exactly; it will not deteriorate from age unless it is in use. That is to say the structure itself does not change is the result of use, provided the stress which it is subjected to does not exceed the safe limit.

- Mr. J. I. Haycroft. 4533. Not a rail in use? A rail in use, making due allowance for wear and tear, is as good on the day it is taken up as it was on the day it was put down. By that I mean that the material of which the rail is composed is as good on the day it is taken up as on the day it was put down.
- 10 May, 1892. 4534. *President.*] Then stuff that is bad now must have been bad always? Undoubtedly. Traffic will not improve it.
4535. *Mr. Hoyle.*] Do you think that a series of percussive blows on a rail would injure its strength? For instance, do you think that the jumping of a wheel would tend to weaken a rail? It undoubtedly tends to the increase of the stress of the fibres over and above the static stress. Every engineer makes allowance for dynamic action in the different members of the structure, more or less according to position, and of course more particularly so on a rail where dynamic action is direct in its incidence.
4536. And does not dynamic action reduce the strength of the rail? Undoubtedly it does. In calculating the strength of a rail the dynamic action should be taken into consideration.
4537. Well, do you think that the dynamic action has reduced the strength of that rail? I can hardly go to that length, but it is a foregone conclusion that a rail with a flaw in it would probably suffer most severely from dynamic action.
4538. Suppose that it had received a number of percussive blows on one side, and that we then turned it down and subjected it to the same process on the other side, do you not think that that would tend to weaken the rail? Undoubtedly, I should think so, as the stress would be reversed. That is the most severe treatment that you can possibly subject iron to—alternate stresses. It has been proved by latter-day investigation to be the most detrimental to the life of any material.
4539. Would not that alter the structure of the iron? Well, I do not hold that theory. I hold that it would affect the fracture, though by different means altogether. There is no means that I am aware of by which the structure of a rail can be ascertained. Whether it is granular or fibrous or any thing else, all depends upon the nature of the fracture to which it has been subjected.
4540. *Professor Warren.*] What about the fracture in the testing machine? That gives you a better chance of observing the material than a fracture by sudden impact.
4541. *Mr. Hoyle.*] If we were going to test that rail, ought we to do it by steady pressure or by the drop test? Steady pressure is one way, but the drop test is more in accordance with the treatment that it is subjected to in actual practice.
4542. *President.*] Then the drop test is the one that you would apply? Yes.

Alexander Duff, being sworn, said:—

- Mr. A. Duff. 4542½. *President.*] How long have you been District Superintendent at Penrith? For three years.
- 10 May, 1892. 4543. You have been there ever since the Baldwin engines have been running? Yes.
4544. Do they haul a greater load than was hauled by the ordinary heavy goods engines that you had previously. I am speaking of the most powerful goods engines that you had on the road before the Baldwin engines came to the Colony. I do not want to know anything about the light goods engines that you had on the road, but I want to know the difference in the load hauled by consolidation engines and the heaviest class of goods engines you had in the Colony before they arrived? The difference is 25 trucks as against 19. The Baldwin engines haul 25 trucks, and the heaviest of the old engines haul only 19.
4545. Then the Baldwin consolidation engine hauls 6 more trucks? Yes.
4546. I take it that you are referring to the goods load? Taking the true load right through.
4547. That is to say that one can haul 6 more trucks than the other? Yes.
4548. Computing the weight at 8 or 10 tons a truck, as the case may be, do you very often employ a push-up engine? In all cases.
4549. Why is that? It is a question of safety.
4550. But in what respect is it a question of safety? In the event of a breakaway going up the mountains.
4551. Would there be a danger of a breakaway in the draw-gear with such a load unattended by a shove-up engine. Supposing there was no engine shoving up behind, would there be a danger of the draw-gear breaking? Certainly, the push-up engine is there for that purpose.
4552. A breakaway would be a very serious matter if it occurred on the mountain gradient? Oh, undoubtedly.
4553. When you are sending your Baldwin passenger engines out, do you often have a pilot engine in front of them? No.
4554. Was there not a pilot engine last Thursday night? As a matter of fact, I was in the train myself, and I know there was a pilot engine.
4555. Can you tell me what load was on the train? No, I cannot; I was away from duty attending the inquest.
4556. Well, as a matter of fact, there were 16½ carriages on the train? I do not think they would employ a Pilot engine with a load of 16½ carriages.
4557. Do you consider they should have a pilot engine to assist in drawing that load? If they had, I think it must have been for some other reason.
4558. A Baldwin engine takes the mail train at night, does it not? Yes.
4559. Does she ever have a pilot? No.
4560. Does she ever have an engine shoving up behind? No.
4561. No assistance at all? No.
4562. About what speed per mile would they have to run between Penrith and Katoomba in order to keep her time-table time? Between 14 and 15 miles an hour.
4563. Do you know whether there have been many fractures of the draw-gear on the trains that the Baldwin engines have been hauling? Not particularly many.
4564. But I imagine that any breakage that did occur would have to be reported to you? Yes, in every case.
4565. Have you received many such reports? No.
4566. Can you say how many you have received? No; I cannot give you the number, but I can say that the percentage is no greater now than it was before the Baldwin engines were introduced into the mountain traffic.

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4567. Does that apply to the passenger or the goods stock? To the goods stock.
4568. You could not have a break-away with the passenger stock, could you, as it is fitted with the automatic break? No; not very well.
4569. But is the draw-gear ever broken in the passenger traffic? No; not to my knowledge.
4570. *Mr. Hoyle.*] Is the draw-gear very much stronger on the passenger than it is on the goods stock? We use the screw couplings.
4571. You do not use them with the goods stock? Not with goods stock, but we do with live stock.
4572. In what part of the draw-gear has the breakage generally occurred? That depends upon circumstances; you very seldom get the breakages alike; the breakage might occur on the rear of the train, or it might happen in the centre of the train, but it has happened very seldom in the front part of the train.
4573. And I suppose that jerks will account for all that? In many cases, no doubt.
4574. And did you find the breakages as numerous when the older engines were doing the hauling? I believe that they were greater six months ago than they are now.
4575. How long have the Baldwin engines been running? Not more than six months, I think.
4576. Can you give me a record of the breakages? Yes; we can supply you with that, I have no doubt.
4577. *Professor Warren.*] They have been supplied already, and are now with the Government Printer.
4578. When you were employing the most powerful engines you had in the service before the Baldwin engines, had you a shove-up engine then? Yes; previous to the present Commissioners taking office I ran more single trains over the mountains than we do to-day. We run them now—particularly double; very seldom single trains.
4579. But when you had a load of nineteen carriages, did you then employ a push-up engine? In what part of the journey are you speaking of?
4580. From Penrith to Katoomba? The utmost load that we should take previous to the introduction of the Baldwin engines was a load of fourteen carriages over that part of the line.
4581. Fourteen carriages without assistance? Yes; without assistance.
4582. And when you had a load of nineteen carriages you had assistance? Yes.
4583. Did you ever try to haul nineteen carriages without the assistance of another engine? Yes.
4584. Did you ever do it? Yes.
4585. Do you remember an occasion, some short time ago, that an engine known as the passengers express engine preceded the Baldwin engine with a load, and got stuck up on the mountains? Yes.
4586. And do you know what engine it was that was stuck up? I cannot speak from memory.
4587. And do you know what class it belonged to? She was one of the old class of engines, and I think that the load was about equal to nine carriages.
4588. Equal to nine carriages, and she got stuck up with it? I believe she did.
4589. Could you tell me what particular engine it was that got stuck up in that way? I could not tell you the number of the engine from memory.
4590. Could you tell us this: if the Baldwin engine could haul the load that they say she could, and she was able to take the additional train as we have been informed she did, why did you send the first engine at all with those nine carriages? She did not take the whole of the train on.
4591. The driver swore before this Commission that the train got in his way—I am referring to the driver of the Baldwin engine—and that he had to take the whole of it on.
4592. Why did you not put them on the Baldwin engine in the first instance? Because it was over the limit of the load laid down for the guidance of the officers.
4593. Is it not a fact that when you run engines to shove up the trains hauled by the Baldwin engines the engine used for shoving up comes back light? It all depends upon the need of the traffic.
4594. Is it a frequent occurrence for these engines to run back light? Yes.
4595. Of course, you know nothing about the engineering branch of your service at all? No; nothing.
4596. *Mr. Fehon.*] Previous to the Baldwin engines running on the mountains with passenger trains, you invariably run the trains with two engines? Yes; it was the rule to do so, not the exception.
4597. The exception is to run one? Yes.
4598. And the two engines used to keep very bad time as compared to the good time kept by the one engine now? Yes; the one engine keeps very much better time than the two did.
4599. You were asked about the breaking of the draw-gear;—breaking of the draw-gear occurs with all engines, does it not? Undoubtedly.
4600. Has the draw-gear been very much strengthened by the Commissioners since they took office? Undoubtedly.
4601. Throughout the whole of the goods stock? Yes.
4602. You stated just now that twenty-five trucks was a load as against nineteen as the load of the old engines;—just think again of the particulars—consider whether you are right? Yes; I am thinking—a through load to Bathurst; but the load that we take from Penrith to Katoomba is twenty-two trucks as against fourteen—a much greater percentage.
4603. Twenty-five trucks against nineteen is like the ruling load;—but is it twenty-five or twenty-eight? It is twenty-eight. When I said twenty-five I was thinking of the number of trucks hauling when they contained live stock. Live stock trains are much heavier than goods trains.
4604. Is it your practice to assist all goods trains with a push-up engine? We do it for safety.
4605. And it has been the custom for years past? Yes.
4606. In fact since the Western road was opened? Yes.
4607. *Mr. Brown.*] So far as your knowledge goes, and your observation enables you to judge, you consider the Baldwin engines suitable to the New South Wales railways? Speaking from a traffic point of view?
4608. I say as far as your knowledge goes, and as far as your observation enables you to judge, do you consider the Baldwin engines suitable for the railways of New South Wales? I do.

WEDNESDAY, 11 MAY, 1892.

[The Commission met in the Board-room, Colonial Secretary's Office, at 2 o'clock.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

ALEXANDER BROWN, Esq., J.P.

Jeremiah Tuite being sworn, said:—

Mr. J. Tuite. 4609. I am manager for Messrs. Proudfoot & Co.

11 May, 1892. 4610. *Mr. Hoyle.*] Previous to going on with the evidence of this witness I wish to make a request to the Commission. I find in the evidence given by Mr. Goodchap yesterday, that he made certain statements which reflect upon the professional ability of one of my witnesses—reflections which I consider are likely to do my witness, Mr. Midelton, serious injury in his profession. I wish to know if the Commission will allow Mr. Midelton to read, without comment, the minutes of his appointment to the position he occupied as Engineer, the letter of thanks he received from Mr. Goodchap during his absence from the position of Engineer, and the minutes upon his reinstatement. They will not take more than ten minutes or a quarter of an hour in reading, and it is a matter of very great importance to my witness that this matter should be cleared up.

4611. *Mr. Brown (for President).*] I do not see how we can go into a matter of that kind. In the inquiry yesterday, you asked a question of Mr. Goodchap with the full knowledge of the responsibility attaching to it. I do not think that I can comply with your request; I have allowed you to make a statement here so that it may go into the report of our proceedings, and that will perhaps have the same effect as if Mr. Midelton were permitted to read the documents you have referred to.

4612. *Mr. Hoyle.*] I also wish to ask that the cost-book or order-book be produced by the Divisional Engineer of Newcastle, Mr. Halligan, dating from the 1st June, 1891, to the present.

4613. *Mr. Brown.*] You have no objection to furnish it, I presume, Mr. Fehon?

4614. *Mr. Fehon.*] Yes; I have a very strong objection.

4615. *Mr. Brown.*] What objection is it?

4616. *Mr. Fehon.*] The objection is to the cost-book. I do not know exactly what it would include.

4617. *Mr. Hoyle.*] I want it from the 1st June, 1891, up to the present?

4618. *Mr. Fehon.*] That would include the whole of the working of the railways during that period. That is to say, long before the Baldwin engines were thought of. If Mr. Hoyle wants any information with regard to any particular item, we shall be glad to furnish it to him.

4619. *Mr. Brown.*] What objection can there be to having the cost-book here for the use of Mr. Hoyle?

4620. *Mr. Hoyle.*] I want the cost and order-book from the 1st June, 1891, up to the present. I want the book for the use of the officers of the Commission to pick out certain information. I wish to point out what I want to them.

4621. *Mr. Brown (to Mr. Fehon.)*] I cannot see any objection with regard to its production. I know I had to supply a cartload of books myself before now for the purposes of inquiry.

4622. *Mr. Hoyle.*] I also want the casualty books since the Baldwin engines commenced to run, and the fitters' repair book to be produced for each district from the commencement of the running of the Baldwin engines, for similar purpose.

4623. *Mr. Brown.*] I suppose you have no objection, Mr. Fehon; as you have agreed to one I suppose you will agree to the other.

4624. *Mr. Fehon.*] It means obtaining the books from all parts of the line, wherever the Baldwin engines have been running.

4625. *Mr. Brown.*] Perhaps Mr. Hoyle will give the Commission some reason why these books should be produced.

4626. *Mr. Hoyle.*] My reason is this. I am not at all satisfied with the return up to the present. I may want it for purposes of verification and comparison.

4627. *Mr. Brown.*] You want it for the purpose of correction; you are not satisfied with the present return, you say.

4628. *Mr. Fehon.*] We shall produce the book and the officer who made the return, and the return shall be ratified by him; but at the same time I think it is a gross insult to us to say that we furnished the Commission with wrong returns. We furnished the Commission with these returns, and are prepared to take all responsibility in connection with them, and I think it is a gross insult to question our honour in this matter.

4629. *Mr. Hoyle.*] I do not question the honesty of the Commissioners, but I wish to have these books simply because I am not satisfied with the return I have seen.

4630. *Professor Warren.*] But there is another return, Mr. Hoyle, which perhaps you have not seen.

4631. *Mr. Hoyle.*] If there is another return I desire to have time to look into its contents. The return I saw was not complete.

4632. *Mr. Brown.*] Then you withdraw your request for all these books to be produced?

4633. *Mr. Hoyle.*] No; not for the cost-books.

4634. *Mr. Fehon.*] Will you specify what cost-books you want?

4635. *Mr. Brown.*] He says he wants them from the time of the importation of the Baldwin engines.

4636. *Mr. Hoyle.*] I want them from the 1st June, 1891, up to the present dates, the cost and order books; there may be more than one book.

4637. *Mr. Fehon.*] I cannot see how the production of these books bears on the inquiry. If Mr. Hoyle wants to make any inquiry, we will produce the man whom it concerns; but we object to hand our books over to Mr. Hoyle or Mr. Midelton, who seems to be the prime mover in this matter.

4637½. *Mr. Hoyle.*] I have before stated that Mr. Midelton or anyone else has had nothing to do in the investigation of this matter. I take the responsibility of my own actions in this or any other case.

4638. *Mr. Brown.*] You have no right to say that, Mr. Fehon.

4639. *Mr. Fehon.*] Well, they will be supplied here in the custody of the Commissioners, and you may see them yourself; they will be supplied in that way, but not to Mr. Midelton.

4640. *Mr. Hoyle (to Witness).*] I believe you are manager for Messrs. Proudfoot & Co.? Yes.

4641. Where are you employed? From the 92 to the 143, at the bottom points of Bathurst district.

4642. Have you been employed always in that district? Well, for about a month or six weeks, some eighteen months ago, I was working between Springwood and Bathurst. 4643.

4643. Had you any other experience of the line before you became manager? Not on any other portion. *Mr. J. Tuite.*
 4644. How long have you been between the bottom points and Bathurst? About eighteen months. *11 May, 1892.*
 4645. Have you carefully examined all portions of the road? Yes.
 4646. Did you walk the road on foot or go on a tricycle? I walked.
 4647. And you carefully examined the road? Yes.
 4648. Were you on board the train on the night of the Tarana accident? Yes.
 4649. Were you asked any questions by the police relative to the state of the road on the night of the accident? A policeman asked me to tell him what I knew about the accident.
 4650. *Mr. Brown.*] We cannot have a question about the police.
 4651. *Mr. Hoyle.*] Well, what is the state of the road between the bottom points and Bathurst? Some of it is in first-class order, and some inferior.
 4652. Do you consider it safe for the Baldwin engines to run over the whole of the road? Well, portions of it are quite safe. Other portions I do not consider safe, taking the weight of the road into consideration. I do not say this with regard to the Baldwin engines only, but to other engines as well.
 4653. *Mr. Brown.*] He says he does not confue himself to the Baldwin engines.
 4654. *Mr. Hoyle.*] You do not consider the road in some places safe for the Baldwin or any engines? Portions I say.
 4655. What portions? Different parts.
 4656. In particular parts you say?
 4657. *Professor Warren.*] Give us a list as far as you can say? Well, from the 114 miles 60 chains to the 124 miles; that is one part.
 4658. That is on the Western line? Yes.
 4659. *Mr. Hoyle.*] Do you know the stone bridge at Bowenfels? I have seen it.
 4660. Do you know anything about it? I have seen flags and flagmen there to steady the train.
 4661. Have there been many rails broken in your district between Bowenfels and Bathurst? I have seen two.
 4662. When? One on the morning of the accident, and the other some months ago.
 4663. Is that since the Baldwin engines have been running? Yes.
 4664. *Professor Warren.*] When you spoke of one on the morning of the accident, you meant I presume the particular one that broke? Yes.
 4665. *Mr. Hoyle.*] And you have seen one other besides that? Yes.
 4666. What distance are the sleepers apart? They vary from 10½ inches, that is the joint sleeper, to 3 ft. 2 in., and 3 ft. 3 in. On curves they are not so far apart.
 4667. *Mr. Brown.*] What are they in the curves? They are from 2 ft. 5 in. to 2 ft. 7 in.
 4668. There are some on the straight at 3 feet? Yes, and over 3 feet.
 4669. *Mr. Hoyle.*] Do you consider the road is in a fit state at the place you have indicated for the Baldwin engine to travel over it at the rate of 30 miles an hour? Portions I consider are not safe.
 4670. *Professor Warren.*] Those portions you have indicated? Yes, as far as I know. I was not employed to look after the road. I was employed to look after the interests of my employers.
 4671. But you know this because you had to look after that section? I have seen it; I have been on the road.
 4672. *Mr. Brown.*] That is, you know it from your own actual observation? Yes.
 4673. *Mr. Hoyle.*] Do you know if the train slowed down anywhere else except at Bowenfels? Yes, at Tarana, at the 120 miles.
 4674. *Professor Warren.*] That is the last of the Solitary Creek bridges? Yes; they call it the Solitary Creek.
 4675. *Mr. Hoyle.*] Did you notice many chairs broken on the road? Yes, a good few.
 4676. And many keys out? Yes. In hot weather an awful lot of keys come out, but in wet weather not so many, the damp swells the wood and holds the keys, but in hot weather the keys cannot help coming out very well.
 4677. If the sleepers were properly packed and were kept in a rigid position, would that hold the keys in, or would they work out more if the sleepers were loose? If there was ballast on the outside of the road it would help to keep the keys in, but in any case in wet weather it would not be so bad, since the timber swells up, consequently the keys are not so liable to come out.
 4678. Can you tell us whether the road between Sodwalls and Tarana has been lifted? Yes, it has all been lifted.
 4679. Lifted and rebalasted? It has been lifted on old ballast. The portions we have relaid between Sodwalls and Tarana have been lifted on new ballast. The only road we have lifted 80-lb. rails have been put down with new ballast, the others have been lifted on old ballast.
 4680. Was the new ballast put on after the road had been lifted with the old ballast? Yes.
 4681. Did you take the ballast from under the sleepers to lift the road? In some parts, but in other parts we had sufficient, there was no occasion for doing it.
 4682. What do you know about the condition of the sleepers? The majority of the sleepers are very good. The ironbark ones we have taken out are nearly as good as the new ones we are putting down.
 4683. How long have they been put down? I do not know. Perhaps twenty-one years. The chairs have worked into the sleepers and made them loose.
 4684. Would the working into the sleepers make the chair loose? Yes.
 4685. Are there straps placed between the side of the cutting and the end of the sleepers to keep the line in position? Yes.
 4686. *Professor Warren.*] That is on the reversed curves? On a close radius curve, about 22, I think.
 4687. *Mr. Hoyle.*] Do you think from the time you have been on the road that the Baldwin engines have knocked the road about much? Yes; I do. I do not mean to say that the 70-lb. rail, with the sleepers closer together, would not be able to carry heavier engines.
 4688. If the sleepers were closer together it would make the road more rigid? Yes.
 4689. Can you tell us what is the condition of the rails on the portion you have done at Sodwalls and beyond, and on the Tarana portion? Some are very fair and others are inferior.
 4690. Did you notice any of them at the joints? Yes; they are all up and down, most of the rails are crippled, and no man could make a good road of it.

- Mr. J. Tufts. 4691. *Mr. Brown.*] You said just now that you did not specially refer to the Baldwin engines, what did you mean by that? There are Yankee engines which I consider almost as bad on the road as the Baldwins.
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4692. And any other engines? The lighter engines I do not say anything about.
 4693. Can you speak generally about the rolling-stock of New South Wales? Yes.
 4694. And that includes it all? Yes.
 4695. You say with regard to the whole of them, in what way do you explain that the road is unsafe? I consider the sleepers in some places too far apart, and a lot of the rails are crippled and cannot be made good.
 4696. *Professor Warren.*] Do you refer to the iron rails, the 75-lb. to the yard? Yes.
 4697. You say the road wants re-sleeping and new rails in certain places, and then it would be perfectly safe for ordinary practical work? Yes; I think so.
 4698. *Mr. Brown.*] Would that be a heavy expenditure? I do not think it would.
 4699. Is there anything now so far as the public is concerned to alarm them with regard to the traffic on the road; need the public be in any way apprehensive with regard to these roads. You must remember that you are giving evidence for the Commission with a large responsibility, and I now ask you if the road is safe, and whether there is any necessity to create any public alarm with regard to the state of the road? No; I do not think so.
 4700. You are speaking for Mr. Proudfoot, and you are a practical man? I am not speaking for Mr. Proudfoot.
 4701. But you have been under him, and he is a large railway contractor and understands his business, and you are speaking with a practical knowledge of the line, do you say now that the road is safe so far as the public are concerned, and they need not be under any apprehension with regard to them?
 4702. *Professor Warren.*] The 114 miles 60 chains to the 124 miles is, I take it, mostly of iron rails? I believe there is a little steel rail.
 4703. Do you consider that portion had also? Yes; for the sleepers are wider apart.
 4704. It is bad then because the sleepers are too widely spaced? Yes.
 4705. And the rest of the road you say is bad because the rails are crippled, that is, practically worn out? Yes.
 4706. Then they are bad for that reason, and also because the sleepers are too widely spaced? Yes.
 4707. You say the engines still slow down over Tarana bridge? Yes.
 4708. Do you know the reason for that. Tarana is the last of the bridges that are known as the Solitary Creek bridges. There are about six of them I think, and five of them are before you come to Tarana. Tarana is a double spanned bridge, but the others I think are single spanned. Do you know why they slow down there? Yes, they slow down at Bowenfels for about 4 or 5 miles an hour.
 4709. Bowenfels is a stone bridge? Yes.
 4710. Did you ever notice them slow down between any of the bridges between Bowenfels and Tarana? No, I cannot say that I have.
 4711. So far as I know there is no difference between Tarana and the other bridges, they are all Solitary Creek bridges; you say you noticed broken chairs? That is on different portions of the line.
 4712. You say you think the Baldwin engines knock the road about. Do you mean the Baldwin engines which were running on the road before the recent importations, you were not referring to the Baldwin engines shown in the photographs placed in this room? No, not particularly.
 4713. You say they knock them about, and the other engines also knock them about? Yes.
 4714. Do you think that if these sleepers were more closely spaced, and the iron rails were replaced with say, 71-lb. steel rails, there would be any danger? Not if they were properly lifted and ballasted, and the sleepers put closer together and the rails renewed. If that were done, I think the road should be competent to carry a heavier rolling stock than now.
 4715. If the permanent-way were put into position, and the present rails replaced by heavier ones, you say the road would carry heavier engines than the Baldwin engines? Yes.
 4716. *Mr. Fehon.*] Are you now in the employment of Mr. Proudfoot? Yes, sir.
 4717. Are you working on the road now? No, I am looking after his plant at Tarana.
 4718. You are not working on the road then? No.
 4719. Your contract has been discontinued? So far as my part is concerned, I do not know with regard to others.
 4720. What was your contract with the Commissioners? It was for re-laying and re-ballasting.
 4721. And the Commissioners have stopped Mr. Proudfoot from relaying and reballasting? Yes.
 4722. You say you have seen broken chairs; well, I suppose you have seen broken chairs whenever you were engaged on permanent-way works? It is the usual thing.
 4723. Have you seen a larger proportion than is customary on most roads upon this one? Yes; I have seen as many as four chairs broken in a 21-foot length.
 4724. Probably that is the result of an accident? I cannot say; but I have seen as many as four in one 21-foot length of rail.
 4725. You say that the keys dropped out, and that they might be kept in with sufficient ballast; now is it customary to ballast the road in order to keep the keys in? No.
 4726. Speaking of the spacing; will you tell the Commission what the spacing is that you have had to carry out under the Commission from centre to centre on the road you have relaid, what is the standard? From 10 inches to 2 feet 8 inches.
 4727. 2 feet 7 inches you mean? Yes; 2 feet 7 inches.
 4728. That is from 10 inches then to 2 feet 7 inches, and that is the maximum allowed in relaying; now with 2 feet 7 inch spacing, and a 71-lb. steel rail, or an 80-lb. iron rail, would you not consider that road secure? Yes.
 4729. What rail have you been relaying with? 80-lb. rails.
 4730. That is the rail they are supplying in all relaying? Yes.
 4731. And for some time past; in fact, during the time you have been on the road? Yes.
 4732. How long have you been on the road? About 18 months.
 4733. And you are laying 80-lb. rails, and were doing so long before the Baldwin engines arrived here? Yes.

4734. You say that the road gets knocked out of line by these engines, but I understand you also to say it is knocked about by all engines more or less; was the road knocked out as much last year by the Yankee engines as it is by the Baldwin's? No; do you mean at the end of last year? Mr. J. Tuite.
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4735. Yes; what is called the Mogul and the Scotch-Yankee engines? Yes, it was; but it was on account of our lifting the road with the old ballast, and there was not enough ballast to keep the road in repair; any engine would at that time I believe be liable to knock the road about.
4736. Would two engines coupled together hurt the road more than one heavy engine? No, I do not think it would.
4737. *Professor Warren.* [*Producing a drawing of the old Consolidation engine.*] Did that engine knock the road about? Yes; if the road was not in good repair that engine would knock it about.
4738. Did you notice whether this engine knocked it about more than the present engine, the newly imported engine? I do not say it does.
4739. *Mr. Hoyle.* Do you consider that, presuming the road had been properly ballasted with new ballast, the Baldwin engines would still have a tendency to knock the road about, that is, taking the sleepers as they are and not as they are going to be,—the width they are apart. Do you consider that the road would then have been perfectly safe for the Baldwin engine? With the same rails?
4740. Yes, with the same rails and the same sleepers? I have just said that I would not think them safe.
4741. *Mr. Fehon.* How many miles have the Commissioners relaid in your length? 14 miles, as near as I can remember.
4742. And you have relaid the worst portions of the road, and the inspectors and engineers have supervised the work.
4743. *Mr. Brown.* I think that goes without saying; you would commence with the worst portion of course? (Witness) We simply did what we were told.

Alexander Ferrier Watson, being sworn, said:—

4744. I am Divisional Engineer in the employment of the Railway Commissioners. I have been in the employment of the Railway Department for seven and a half years. Mr.
A. F. Watson,
11 May, 1892.
4745. *Mr. Hoyle.* Will you kindly tell us where your district extends to? I had charge originally from Springwood to Bourke; I have now charge from Wallerawang to Bourke.
4746. Did you ever make any representations to the Commissioners that the road was being injured by the use of the Baldwin engines? No, sir.
4747. Are you sure about that? Quite sure.
4748. Did you make a report at all? Yes, I made a report on the effect on the road.
4749. And what was the effect on the road?—
4750. *Mr. Brown.* Give it to us just as far as your memory serves; if you cannot remember the contents of the report, then probably the Commissioners will supply it to us.
4751. *Mr. Hoyle.* Did you report that the effect of these engines was injurious? I reported that the road was being knocked a little out of line. Until it was reballasted, and when the ballast was put on it stopped that action.
4752. Do you consider the road from Wallerawang to Bathurst is now in a fit state to carry the Baldwin engines? Yes, sir, I do.
4753. You do? Yes.
4754. Do you know the strength of the bridges? The ultimate strength, do you mean?
4755. *Mr. Brown* (to *Mr. Hoyle*). Tell him the weight of the engines passing over them. Do you know the weight of the Baldwin engines? Yes.
4756. The passenger engine is about 92 tons, and the consolidated goods engine from 97 to 98 tons? Yes, so I understand.
4757. Do you know the weight on the driving-wheels? On the passenger engine it is about 15 tons 6 cwt., and on the goods 15 tons 9 cwt.
4758. *Mr. Hoyle.* Now, do you consider that with that weight on the driving-wheel that the whole of the road between Wallerawang and Bathurst is perfectly safe? Yes, I think it is safe.
4759. Can you tell us how the sleepers are placed on that section? On the iron road 3 feet 1 inch, and the joint sleepers are about 2 feet 4 inches apart generally speaking, on the curves they are closer.
4760. Can you tell us the distance from centre to centre of the sleepers on the curve and on the straight respectively? On the straight they are about 3 feet 1 inch, and on the curves they are about 2 feet 10 inches to 2 feet 8 inches. I mean from centre to centre.
4761. *Professor Warren.* What is the distance of the joint sleepers on the curve? Two feet two inches.
4762. *Mr. Hoyle.* Are you taking the centres? Yes.
4763. In what condition are the rails between the 117 miles and the 223 miles beyond Bathurst—do you know? There are various rails on that portion; there are iron double-headed, steel double-headed, and steel T rails on that length.
4764. *Mr. Brown.* Generally, Mr. Hoyle wants to know the condition of the length? Steel rails are in first-class order; the iron rails are not in such good order.
4765. *Mr. Hoyle.* Not in good order? Fair order.
4766. Do you know when the rails were made—I mean the iron rails? There are various brands—the Parkgate, and so on.
4767. Is it a fact that when the outer skin is worn you turn a great many of these rails? Yes, they are turned when they get too thin or flat, or when they bulge.
4768. What do you think would be the proportion of the weight lost by the wearing off from the rail—what proportion do you reckon would be worn off when it becomes necessary to turn a rail round? About 2 to 3 lbs. per yard.
4769. You then turn the rail over, and that process of decrease goes on upon the other side? Yes.
4770. Do you know if there have been many chairs broken between Tarana and Bathurst? Yes, sir; there have been many chairs broken.
4771. Have there been more since the Baldwin engines have been running? That is a hard question to answer, and could not be answered unless by counting the numbers. We have always found broken chairs on the road, and are continually changing them.
4772. Have you found more since the Baldwin engines have been running?— 4773.

- Mr. A. F. Watson. 11 May, 1892. 4773. *Mr. Brown.*] You can say generally what you think? Since the road was lifted I have found more.
4774. *Mr. Hoyle.*] Were you ever notified that the road where the accident happened was not in a fit state to run on and wanted repairs? No, sir.
4775. Have you received any complaints from your inspectors or gangers about the state of the road since the Baldwin engines commenced running? They all complain of the work.
4776. Since the Baldwin engines have been running? No; generally in the busy season.
4777. Have you received more complaints since the Baldwin engines have been running either from inspectors or gangers? No, I cannot say that I have.
4778. Did you ever make a request that this portion of the road should be relaid? Yes, sir, I have.
4779. Why? Because the sooner we put down steel rails the stronger and better our road will be.
4780. Do you mean in view of the weight of the rolling-stock, &c.? No, generally, to keep the road better for general traffic. It is not on account of the Baldwin engines.
4781. When was that request made? When we started relaying, about September or October, 1890.
4782. Is it a fact that new materials were laid along the line for that portion? Yes, sir, they were laid along a portion of the road.
4783. That is the portion where the accident occurred? Yes, there were some rails laid along there.
4784. And why were they removed? Because a programme of the amount of work to be done was curtailed.
4785. Do you know why?
4786. *Mr. Brown.*] He cannot tell you. I suppose it was want of money.
4787. *Mr. Fehon.*] Yes, sir.
4788. *Mr. Hoyle.*] Has not a portion of that road been lifted and packed with new ballast within the last twelve months? Yes, a good deal of it.
4789. Which portions? From September and October, 1890, up to date, we have relaid and repacked with new ballast $13\frac{1}{2}$ miles between Wallerawang and Tarana.
4790. When the road was packed between Wallerawang and Tarana with old ballast, did you expect the road to stand then? Yes; we expected it to stand, but being lifted it would take a little time to consolidate again. We lifted the old road on top of the old ballast, and it requires consolidating and boxing up with new ballast.
4791. *Mr. Brown.*] That is the case with every road? Yes, sir.
4792. Have you found many broken fish-plates on your length of road lately? Yes, sir.
4793. Did you find many before the Baldwin engines commenced to run? They were not-reported specially. We did find broken fish-plates.
4794. How many rails have been broken in your division within the last nine months? Nine months—do you mean broken across in two pieces?
4795. Either broken or fractured in any way—cracked? Yes; we had a good many.
4796. Since the Baldwin engines commenced to run? Yes, and before.
4797. Did you find the proportion any greater since the Baldwin engines commenced to run? We found more fractured rails because the road has been lifted, which shows us more of the defects—because the road is raised and all the defects are visible.
4798. Then it could not be safe if sunk into the old ballast.
4799. One of your witnesses told us that in one case it almost took a microscope to see a fracture.
4800. *Mr. Hoyle.*] Do you think, taking the road between Tarana and Bathurst, that it would be perfectly safe for a passenger engine to run on that road at a pace of 40 miles an hour?
4801. *Mr. Fehon.*] Where?
4802. *Mr. Hoyle.*] Between Wallerawang and Bathurst. I want to know if there are portions of this road between these points that it would be safe to run the Baldwin passenger engine over at a speed of over 40 miles an hour? Yes; I should think it would be safe on the long straights.
4803. You think it would be perfectly safe with the sleepers placed as they are, and with your knowledge of the condition of some of the rails? Yes; I think so.
4804. *Professor Warren.*] On the straight portions you say? Yes.
4805. What about the curves? The speed must be limited round the curves.
4806. How much? To 28 miles an hour.
4807. Then you could run round a 10-chain curve with perfect safety on this road at 20 miles an hour? I have only one 10-chain curve, and that is laid with steel. The next smallest curve I have is a 12-chain radius.
4808. Well, say a 12-chain curve at 28 miles an hour—do you think that would be safe? Yes; I think so.
4809. *Mr. Fehon.*] The speed is 25 miles an hour round the curves, and not 28 miles.
4810. *Mr. Brown.*] The witness says that it is 28 miles an hour, and that is what the question was based on.
4811. *Mr. Hoyle.*] Well, say 25 miles an hour—do you think it would be perfectly safe to take that curve at that rate? Yes, sir. The reason I said 28 miles an hour was on account of the super-elevation of the rail which is made to suit.
4812. Do you consider it safe to run any of these engines over the bridges of your district at this rate? Not at a high rate of speed.
4813. Have any of the bridges in your district been strengthened? Was the Solitary Creek bridge strengthened? That is an iron bridge; that has not been strengthened.
4814. And the wooden bridges? Some of them; we have strengthened small flood-openings.
4815. But have they been strengthened since you have been in that district? No, not generally speaking. I have put some little additions to the bridges, but I have not strengthened them all generally.
4816. Have you used the slow-down notice to any of the drivers passing over the road between Bathurst Wallerawang? Yes; over the bridges.
4817. And not over any portion of the road? No, except where lifting or relaying.
4818. I mean, you know, slow over the bridges; and, except where you state it is unsafe, you travel on the road at a high rate of speed? Yes.
4819. Do you consider that if we had bad wet weather on the mountains that these engines would still be safe to run at the speed indicated on portions of the road between Wallerawang and Bathurst? Yes, sir, because the ballast has been added to.

4820. Are there portions where you have recently had no new ballast, where they have not been ballasted recently? Yes.
4821. Would it be safe on those portions? Yes; between Kelso and Bathurst there has been no ballast.
4822. How long is it since the order has been issued to slow down over the bridges? Seven or eight months ago.
4823. Are there any portions of the road in your district where it is in a worse state than that portion where the accident occurred? Yes, I think so.
4824. What portion is that? Between the 121 miles and 18 chains and the 124 miles.
4825. And would it be perfectly safe for these engines to run over these portions at 30 miles an hour? Yes, I think so; it is a question of worn rails, and the rails are very much worn.
4826. Were you on board the train when the accident happened? No, I was not.
4827. Can you tell us whether there has been a rail broken between the scene of the accident and Tarana since the accident occurred—any broken rail? Not actually broken across; there have been rails found, by careful examination, having little flaws in them.
4828. Cracks? Yes; cracks, fractures.
4829. But not actually broken across? No.
4830. Are you not now renewing with iron rails many of the old rails between Tarana station and the scene of the accident; are you not now taking out a number of rails and putting others in their place? Yes, sir; we have been doing that every day both before and after the accident.
4831. Have you had any extra men on besides the usual gang on the road lately? Yes; I have put on temporary men to assist the fitters with extra work.
4832. Have they ever complained to you since the Baldwin engines commenced to run that the work was too great, and they found it difficult to keep the road in a proper condition? They say that a great deal of time is taken up changing rails and keys and chairs both before and since.
4833. But have you more complaints since than before these engines commenced to run? I cannot say; it has been a general complaint for the last five or six years. Men brought from the Western line, where the T rails are used, have found the work so hard that they have complained.
4834. *Mr. Brown.*] Do you consider, from what you know of the Baldwin engines, that they are suitable for the permanent-way of the railways of New South Wales? Certainly, sir.
4835. *Professor Warren.*] You say that the engines slow down over certain bridges;—did you receive instructions from the guard of that, or was it due to reports made to you? I did it on my own responsibility.
4836. What speed did the engines run over the Solitary Creek bridges? They run over five bridges 15 miles an hour, but on one bridge the speed is limited to 10 miles—that is at Tarana.
4837. Do you consider them to be safe with the trains travelling at those speeds? I do.
4838. I suppose you base your opinion on what you actually know of the bridges? Yes; I tested them for deflection.
4839. And what did you infer from the test;—the deflection produced by a heavy engine, what does it tell you? I noticed a marked difference between a low speed of 20 miles an hour and a high speed of 40 miles an hour.
4840. And how did you infer the safety or otherwise of the bridge from these deflections? We found that the cross-girders deflected more than the main ones.
4841. Do you consider then that the cross-girders are weak and the main girders strong enough;—what, in fact, is the weak point? The cross-girders.
4842. You consider the main girders are fairly strong? Yes; fairly strong. That is my opinion.
4843. What do you consider to be a safe stress on a bridge of 60-foot span, loaded with an ordinary engine—a bridge such as the Solitary bridge? I think it should not be strained more than 5 tons to the square inch of tension.
4844. Do you know what the strain is in the case of the Solitary Creek bridges? No; I have not worked it out.
4845. What is the good of giving an opinion if you have not worked it out? I give it from the deflection.
4846. Can you infer the stress from the deflection? You can infer the stability of the bridge.
4847. The stability of the bridge differs from the strength, and the strength differs from the stiffness;—what do you infer? That the bridge is not stiff enough.
4848. Yes, that is very true; you did not work out what must have been the stress on bridges in consequence of that deflection? No; I think that was worked out by yourself and another gentleman on the Royal Commission held with regard to bridges some years ago, and you then made certain recommendations to strengthen these bridges.
4849. You remember that; then I will quote from that report the total load on the Solitary Creek bridges; it is 6·75 tons per square inch in tension;—would you consider that bridge to be strong enough? The load should not be more than 5 tons.
4850. Well, the Baldwin Consolidation engines weigh more than the Baldwin engines used in this particular case, and therefore, if it was not safe for the ordinary Consolidation engine, would you not consider it less safe with a greater load of the newly-imported engines? Yes, sir; but does it not depend upon the base covered?
4851. The bridge is 60-foot span, and you have the base of the Baldwin engine; you can get one Baldwin engine on that bridge, and you can only get one old Mogul, so that the bridges, if unsafe for the lighter engines, are still more unsafe for the heavier? But you do not limit the speed for the lighter.
4852. So then you think the speed has got something to do with it? Yes; and the deflection which you get on the bridge, and the load you use, and the engine which you use.
4853. Can you tell us what engine you used in making your test? Yes; it was the new Baldwin passenger engine.
4854. It produced what deflection? Well, the records are all in the Sydney office, they are not with me, and I have not seen them for months since. It is a long time ago, and I could not give it to you from memory. I should prefer to refer to the cards themselves.
4855. Do you know about what the deflection would be; was it about half an inch? I think it was about five-eighths.
4856. And what speed was that? Well, we made the engine stand on the bridge first, and then I ran her over at 30 miles an hour, and increased to 40 miles, I made the man go as hard as he could.

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- Mr. A. F. Watson. 11 May, 1892. 4857. Did it make much difference? Yes. The deflection was so great and the vibration so much that I wish no other engine to go over at that speed.
4858. Did it deflect an inch? I cannot say exactly.
4859. However, an inch is a great difference? Yes.
4860. The stress as stated in the Report to the Commission is 6·75 tons;—well, now, the total load on the bridge was 2·26 tons per foot;—with the Consolidation it is 2·76 tons per foot;—it is merely a question of arithmetic, and it produces 8·24 tons, now is that safe? Was that with the engines standing, or going at a high speed.
4861. It merely takes the load itself, it does not mean that the engines run at a high rate of speed;—now is it safe with 8 tons? It may be safe, but I should like to see the bridge stiffened and strengthened.
4862. If you say it is safe, I must ask you some more questions, the ratio of the standing load to the running load is as ·76 to 2·76;—when the live load goes on from the Baldwin engine the ratio rises from ·76 to 2·76, what would be the breaking strength of iron with a number of repetitions, assuming that it would take 21 tons with the stress first applied, what would it take when applied under these conditions for ten or twelve years;—from ·76 to 2·76 would be about 16 tons, the iron would stand say 21 tons, when first put down would it stand more than 16 tons under these conditions for breaking? It depends upon the quality of the iron.
4863. Take it at 21 tons at a fair average, you know perfectly well that the strength of the bar is determined by the manner in which it is loaded;—if it has always a certain steady stress on it it may stand say 21 tons, what would it stand if it varies from ·76 to 2·76 that is about the range? It would stand something less than that.
4864. About 16 tons do you think;—well, assume it to be 16 tons, what average of safety have you? For a steady load it ought to be a quarter. I should say they were considerably strained, but I would not positively say they are unsafe.
4865. Have you ever heard of a bridge being strained so much even in America, which still stood up? These bridges are built on the skew, therefore they are a little stiffer.
4866. But you get five-eighths deflection? Yes.
4867. I do not think you are far out, because I know what it goes with the others, you say means have been taken to strengthen these bridges, you know what they are? My chief engineer, Mr. Foxlee, has the matter in hand. I do not know how far it is in hand, but I believe there are plans got out for the strengthening of these bridges.
4868. Now, with regard to the iron and steel rails on this length, you admit that there are many broken rails from time to time, and broken chairs;—with sleepers 3 feet each apart on the straight, and with steel rails 71 lb. per yard, do you consider they are safe to carry a Baldwin engine—passenger or consolidation engine? Do you mean the double-headed steel rails.
4869. We have it in evidence that the rails are 71 steel and 75-lb. iron? I have always considered the rails to be 75 lb. per yard, and we have a few miles of double-headed steel rails.
4870. What do they weigh per yard? They were considered to be about the same weight as the iron rail, there are 3 miles of the double-headed rails.
4871. Are they the oldest? No, the oldest are T rails. We have 71-lb. T rails beyond Bathurst.
4872. You have all sorts of rail sections in this length, and I take it you have some of the double-headed iron and double-headed steel rails? Between Wallerawang and Bathurst we have double-headed steel, in the west we have steel T rails.
4873. And these weigh about 71 lb. per yard, do you consider the Baldwin engines safe with the double-headed iron, double-headed steel and T rails on the line? Yes; taking into consideration the curves, and if you do not travel too fast on the rails they will carry you.
4874. Mr. Fehon.] You say that the road is a good deal knocked about? Yes; I mentioned that in my report.
4875. Because it was not properly ballasted? Yes.
4876. And since it has been lifted and reballasted you have got rid of that complaint? Yes.
4877. Did you not write to Mr. Foxlee that you found the Baldwin engines were running as easily as any other engines on the road? Yes; and I think they go remarkably evenly on some parts of the roads.
4878. When sleeping a curve what is your custom, a curve over 15-chains radius, and a curve under, when it is over how many additional sleepers do you put in in? For a 15-chain curve you would put in one additional sleeper, and under fifteen you put in ten sleepers to a 24-foot rail.
4879. What do you put in when it is under fifteen? You put in an additional sleeper in 15 chains, and under we put in one additional sleeper.
4880. Under 15 chains you put in two additional sleepers? Yes.
4881. Do you know the English custom of putting in sleepers? I have not had any practice in the English custom.
4882. You say that the broken chairs and fish-plates were the result of the road being lifted? Yes; a great deal.
4883. And that it was not due to any particular class of traffic running over it? It was due to continual traffic, such as heavy wool trains running over it.
4884. You say it would be more likely to break a fish-plate or a chair on a newly made road? Yes, sir.
4885. Mr. Hoyle.] You said you had some double-headed steel rails on some portion of the road, do you know the weight of those rails? No, I do not.
4886. Are you a member of the Institute of Civil Engineers? No, I have not that distinction.
4887. Are there any men in your portion of the district now being started to relay the line? Yes, sir.
4888. Have you received any orders from head-quarters that gangs of men are to be put on to relay any portion of your district? Yes, sir I have. From 114 miles 60 chains and carried on.
4889. You say that you sent in a report about the state of the road since the Baldwin engines began running, do you know if that report is in existence? Yes, I think it is.
4890. Mr. Brown.] How can he tell you that?
4891. Mr. Hoyle.] I should like to have the report put in.
4892. Mr. Brown.] Well you can have it if the Railway Commissioners can find it.

Henry H. Park recalled :—

4892½. *Mr. Hoyle.*] Is it a fact that on one of the engines now in your district there was a wheel with a broken tyre? No, not exactly, not a wheel of the engine.

4893. Is there a broken tyre in any of the tender wheels? There has been one, but it has been replaced by another tyre.

4894. Can you tell us when or where it was broken? I cannot; the number, I believe, was 485.

4895. Is it a tender or an engine wheel? It is the tyre on the left leading wheel of the tender.

4896. Is it a bad break? It is broken right through.

4897. Is there anything else the matter with the wheels of the engine, is there a loose tyre on any of the wheels? There is one showing signs of being a little loose when it is hot, but when cool it is quite sound by sounding it with a hammer, it shows signs of being loose when it is hot.

4898. You say it has been evidently loose? Yes.

4899. What wheel is that? It is on the engine 485 on the second leading wheel.

4900. Have you had any tubes leaking in any other engines since you were here last, was there any leaking in No. 485? I cannot say from memory.

4901. Can you tell us whether one engine broke down on the 1st May, and returned from Langton with reversing-gear carried away? On the 1st May?

4902. Yes, did an engine break down since you were here last, from the reversing-gear giving way? I cannot call it to mind.

4903. Are there any of the engines in your district cutting into the boxes or with the connecting rod point out of gear? I do not think there are in my district.

4904. Are there any more engines in your district with loose tyres? No.

4905. Or loose wheels? None that I am aware of.

4906. The only one you know of, apparently, is the loose tyre on the engine wheel when it is hot, and the tyre on the tender wheel? Yes.

4907. *Mr. Brown.*] How many engines come into your shed? Eleven in my district, and two from Bathurst.

4908. Since that time, in the matter of the tyre, is the only thing of importance that has occurred with regard to these engines? Yes.

4909. Is it not a dangerous thing for a tyre to break? Most decidedly it is.

4910. And is it not dangerous to have a tyre loose on the wheel? Well, that is according to how loose it is.

4911. *Professor Warren.*] Do you consider the second tyre that is working loose to be dangerous? No, I do not say that I would stop the engine at once for it.

4912. *Mr. Hoyle.*] Will this engine now be allowed to go out with the tyre loose? Yes.

4913. You do not consider it sufficiently dangerous to keep it in? No; I say I would not stop it from running.

4914. How is it fastened? With bolts.

4915. *Professor Warren.*] Would it tend to any accident? No, sir.

4916. *Mr. Hoyle.*] Do you know if any of the engines gave any trouble through the tubes leaking? I could tell you one if I looked at my note-book. [*Referring to note-book*] No. 502.

4917. Is anything the matter with No. 485? Not that I am aware of.

4918. No. 488? Not that I am aware of, more than ordinary repairs.

4919. Can you tell us whether the mail has been running to time since the accident? The up or down mail?

4920. The up mail? I cannot answer that question.

4921. It does not come in your department? Yes, it does; but it is a Bathurst engine, and is not run by me.

4922. If they do not run to time would it be reported? There is a note made in the book, but it is reported back to Bathurst, to their inspector.

4923. *Mr. Fehon.*] Have you ever noticed that the tyre on any other engine wheel would become loose from excessive braking down the Mountains? Yes, sir; I have known many.

4924. And this is not exceptional? No, sir.

4925. Have you reported this loose tyre? No, sir; I did not consider it of sufficient importance to report, as it is at present.

4926. Can you tell us, then, how Mr. Hoyle has got this information about a trifling thing, so small that you did not consider it worth reporting?

4927. *Mr. Brown.*] Ask him something easy?

4928. *Witness.*] I do not know; I know that he did not obtain it from me.

4929. *Mr. Fehon.*] Are you related to Mr. Midelton? No.

4930. *Mr. Midelton.*] Mr. Fehon knows perfectly well that I have no relatives in Australia.

George Gasgoigne, being sworn said :—

4931. I am an engine driver stationed at Penrith, sometimes I drive to Sydney, and sometimes to Bathurst. I have been in the Government service for twelve years and six months stationed at Penrith. I have been driving for seven years, and was firing five years before that.

4932. *Mr. Hoyle.*] Have you driven the Baldwin engines? Yes, every class of them, except the passenger Baldwin. The old goods Baldwin, and the new goods Baldwin I have driven.

4933. Had you any trouble with these engines? I have had a little; they have been a little short of steam sometimes, but nothing extra.

4934. Can you tell us this, is there any special class of coal kept at Penrith for these Baldwin engines? Yes.

4935. And are other classes of engines allowed to use this special class of coal? Oh, no.

4936. You said just now that you had some trouble with the steam—what caused that? We mostly reported it through inferior coal.

4937. Do you know what it was in the Baldwin engines that made you use a special coal? No.

4938. Is it only kept for the passenger engines? I believe it is kept as far as I am informed for the goods engines, that carries the mail train to Katoomba.

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- Mr. G. Gasgoigne. 4939. Had you any leaking tubes in the engines you were driving? Yes, I have.
4940. Have you had any breakage on reversing or brake gear? I have had the brake-gear give way.
- 11 May, 1892. 4941. Why? I think it is too light.
4942. Was it through rough handling? The guard never complained to me about using the gear roughly.
4943. Were you ever reported for using it roughly? No, I think it was through bad rolling and bad welding. I know for a fact there were bad welds.
4944. Did any of the engines run hot? Yes, I had a great deal of trouble with No. 491. The engine was running hot before I got her.
4945. What wheels were running hot? The trailers and leading bogies, the right bogie especially. I was asked once to leave this engine in Bathurst, but I asked to have her for another trip, to try and get her round, and I found I was successful. I found the boss of the wheel was cutting into the boxes very badly, and I used artificial means to enable the oil to drop between the boss and the wheel, and so put a face on the wheel boss, and so with a little skill I got the engine to run very passably, she was very bad when I first took her in hand. It appears that the first trip she ran from Sydney this was caused.
4946. Was this the bogie wheel which was renewed? I do not think it was renewed, or if so it has been renewed since, but I do not know.
4947. Had you ever any trouble with the feeders and injectors? Yes, I found that the flange of the leading tender wheel shut the water off and I complained to my inspector about this. There is a stop-lock which is at the back of the leading tender wheel, and in the curves of the flange of the wheel touches it so as to shut the water off. There is no doubt about that.
4948. Did you find that these engines consumed much coal? There is no doubt that they consumed a great deal of fuel, because they haul such a very large load.
4949. Did you have an engine to push up behind? Generally.
4950. Do you know whether that engine brings another load back to Penrith or comes back light? Well, I have pushed up and I have come back light.
4951. Did you generally come back lighter? Sometimes at Glenbrook they pick up a part of the load left by the Baldwin engines or other engines, thrown off there. I saw many light engines. The last time I was at Katoomba I came back with a light engine.
4952. Did you think the tender strong enough to carry water? Well the tender is on a little slope, and the plates were loose on the top of the tender. I have found there were several rivets beginning to leak, and when the tender is full of water you would see the plates heave up and down with the weight of the water.
4953. *Professor Warren.*] Do you mean that they will buckle? Yes; but when the water gets a certain distance down there is no harm done, and if you have filled the tender right up with water then the plates buckle. It is the weight of the water through the tender being sloping. You will see the plates rock and buckle.
4954. *Mr. Hoyle.*] Do you think that the strength of the piston with the brake gear is strong enough? I never gave it any consideration. I never had any trouble with the brake.
4955. Did you find the wheels moved loose on their axles? I was told that they had been found by the fitter to move as much as 2 inches. That fitters name was Wilshire.
4956. Is that serious? Well it is not very pleasant.
4957. Did you find with these engines that they rolled much? If you go into the curves at any pace they do.
4958. You say you have been a driver for seven years? Yes.
4959. And have run over the Western road with all classes of engines, except 447 class. Well, do you consider, in all the experience you have had, that it would be safe, say on a 12 chain curve, to run these engines at 25 miles an hour? I should not like to do it.
4960. Would you do it? No.
4961. Why? Because I do not think it safe.
4962. *Mr. Fehon.*] His engine is only allowed to run at the rate of 18 miles an hour.
4963. *Mr. Hoyle.*] Well, would you take a curve at 18 miles an hour? Well, I have not done so and I would not like to. They are rough enough at a steady pace. They are a good driving engine on a straight road, and they are not so bad in the curves if you are going at all steadily, but if you come into the curves at a good pace they give you a nasty chuck.
4964. Then you must go very steadily into the curve less you be thrown off? Well, I do not know that they would throw you off, but I think it would be detrimental to the engine, the boss of the wheel touches the box and starts it to heat with the pressure put on the boss.
4965. You have had some experience of driving over [the road before the Baldwin engines came here, what did you drive at that time? The old Baldwin, the 131 class.
4966. That is known as the original consolidation engine? Yes; and I fired on that class for four years.
4967. When travelling a driver can feel the road can he not? Yes, to a certain extent.
4968. Do you find that you feel the road more now than before you drove the new Baldwin engines? Well, it is pretty rough.
4969. Do you consider it worse now than before? I think that the greater portion of the old road that has not been relaid is worse, actually worse than it was before.
4970. Do you know whether the engine is severe on the draw-gear? Well, I can say that there is more broken draw-gear since the new engine came than before. I was driving for some seven years and I never had a broken draw-hook before these engines came, but since then I have found that I am not more infallible than any other men.
4971. Have you had much draw-gear broken? I think I have had seven hooks.
4972. Was that on the engine or trucks? On the trucks. On the engine I have had one because I had the engine coupled in front.
4973. Oh, you had one on the engine? Yes; from Clarence to Bell. I had a load of thirty-one of coal and two brake vans.
4974. Do you consider it safe on the draw-gear to haul such a load as that? I thought it was too much. I once came into Sydney on a deputation from the drivers *re* hauling loads on the mountains; the drivers thought that they were dangerous, and I was sent to represent the drivers *re* the heavy loads, that must be nearly two years ago.

4975. Would you prefer to drive one of these engines to the Scotch Yankee? No; I would rather drive the Scotch Yankee.
4976. Did you find a tendency in the Baldwin engines to throw you off the foot-plate in taking the curves? Yes. I think they have a tendency that way, they are so high for one thing.
4977. Have you ever heard the drivers complain about these engines; those who have driven them? Yes.
4978. Do you know any of the men who have thus complained? I have heard Driver Elliott say he hopes he will never go on them again, and he has driven both classes, and when starting work about a fortnight ago I met a fireman and he said, "I am glad I am off them, and hope I will not go on them again."
4979. Why? They consider they are heavier, and they are not so healthy as the other engines.
4980. What do you mean by healthy? They are so hot, and then you have so very little room.
4981. *Professor Warren.*] You did not like the arrangement on the side; in fact, you would rather stand in front, with your hand on the regulator? It is not like the old Baldwin; there is more room in them. I refer to the 131 class. I never wish to drive a better engine than the old Baldwins; you can stand safer to your work, and see where you are going.
4982. Did you drive them like the ordinary engine? No; there is a regulator just like that on the new ones; but they are not so high up, and you can stand in the front to your work.
4983. They do not have such high boilers as the new ones, you mean? No; the new ones have a very high boiler, and you have to stand at the side, and if you put your head out at the window you are liable to be knocked out by some obstruction if you are driving in the dark.
4984. Then it would not be safe to stand on the side in the dark? It would not be a safe place to sit in the window.
4985. *Mr. Hoyle.*] Do you think it would be safe in the case of a passing engine? Well, I have seen an order not to lean out on the cabs, as it is dangerous to do so.
4986. Is there any notice to that effect on the engines? Well, I believe there is.
4987. Is there on your engine? I am not driving one now.
4988. Have you ever driven the engine that takes the mail—have you ever driven the Western mail train? I have not driven the mail from Penrith to Katoomba with one of the Baldwin engines.
4989. Can you tell us what was the greatest load that you have taken from Penrith to Katoomba without assistance of other engines? Do you mean the new ones?
4990. Yes? I am sure I cannot remember just now.
4991. *Professor Warren.*] Does it matter?
4992. *Mr. Hoyle.*] Perhaps not.
4993. *Professor Warren.*] We are mostly concerned with the other ones—with the new Baldwins.
4994. *Witness.*] I can tell you the largest load I have hauled with the new ones on the mountains.
4995. *Professor Warren.*] You may as well do that.
4996. *Mr. Hoyle.*] Give us the heaviest load that you have hauled with them? I think it was 219 tons, including two break-vans.
4997. Two hundred and nineteen tons, exclusive of the engine? Yes.
4998. *Professor Warren.*] What speed can you travel at with such a load as that? I can hardly say exactly.
4999. Well, tell us approximately—as near as you can; did you go at the rate of 4 miles an hour? A little faster, but not much.
5000. Could you do 10 miles an hour up the 1 in 30 with that load? No, not up the 1 in 30.
5001. Well, how fast did you go up that incline, do you think? At the rate of about 6 miles an hour.
5002. *Mr. Hoyle.*] Then you had two break-vans? Yes.
5003. Had you any assistance? No other engine was attached to the train. They were all heavy waggons; it was a train of ballast that I lifted at Emu Plains.
5004. What is the biggest load that you have hauled with the other engines? I cannot say.
5005. What do you think? I took 219 tons (nineteen trucks and one large break-van) up Dargen's with a pressure of 110 lb. to the square inch; that was up an incline of 1 in 33.
5006. And what is the pressure in the Baldwins? 160 lb.
5007. *Professor Warren.*] The pressure, I take it, has been reduced in the old engines; you do not run them at the pressure you used to? No; they have been very good engines, but they have worn down a little.
5008. *Mr. Hoyle.*] Do you think you could take 200 tons up Dargen's with one of the old Baldwin engines with 160 lb. to the square inch pressure? Well, I cannot say, Mr. Hoyle. I never tried. If the 200 tons were put on, I daresay I would have a good try.
5009. *Professor Warren.*] If you burst the cylinder? Well, it would be more likely to burst the boiler.
5010. *Mr. Fehon.*] Do not all engines run hot during the few first weeks? Yes, the majority of them do.
5011. The Baldwin engines have not run hot yet more than engines ordinarily do, I presume? Well, I had a great deal of trouble with this engine in the first instance. Every man had reported her before I put her right.
5012. At all events you did put her right? Well, I believe that I did.
5013. And she is right now? I am not using her now.
5014. Have you ever driven Vulcan? Yes.
5015. Are they not very rough? Yes.
5016. Are they very much rougher than the Baldwins? Yes, they are very rough.
5017. Do not all engines shake you up when you enter a curve? Yes, they do more or less.
5018. Nothing unusual in it? Too usual sometimes.
5019. At all events you would rather ride round a curve on the Baldwin engine than on the Vulcan at the same speed? I would.
5020. Did you report to anybody that the feed-cocks touched the wheel? I did.
5021. Who did you report it to? To Inspector Stuart, and I also entered it in the repair book.
5022. Have you reported that you considered the plates of the tender weak? No; I have called my superior officer's attention to it, and he has ordered no fireman to break lumps of coal on the tender.
5023. Mr. Park is the only one to whom you have mentioned it? Yes; he is my superior officer at Penrith.
5024. *Professor Warren.*] You say these engines will not steam well? Well, those engines do not steam well.

Mr.
G. Gasgoigne.
11 May, 1892.

- Mr. G. Gasgoigne. 5025. But you found that when you got better coal that you had no trouble from want of steam? I never had the better coal. It was always Eskbank coal that I used. I was never allowed the better coal, although I believe the engines would have steamed better with it.
- 11 May, 1892. 5026. What coal would you have preferred to Eskbank coal? I should have liked Helensburgh coal. There is no doubt about that, if I could have got it.
5027. Mr. Fehon.] That is South Coast coal? Yes, sir.
5028. Professor Warren.] You think the Baldwin engines knocked the road about more than any other engines? I think they are too heavy for the road, and I think they ought not to go so quickly on the curves. From what I read, I see that the Board of Trade are issuing orders on the English railways of 10-chain curves shall be check-railed, and that the speed running over them must not exceed 12 miles an hour.
5029. But from your own experience? I find that they are uncomfortable to ride upon; they throw you.
5030. You broke one hook on the engine? Yes; I only had one break on the engine.
5031. Well, we have nothing to do with anything but hooks on the engines? There was only one engine-hook broken.
5032. President.] And that you put down to the other engine? Yes; it was the front hook.
5033. You say that you would rather drive the Scotch Yankee? I would.
5034. Is it because it is a more comfortable engine to ride upon? Well, they are very good engines to work—that is the Dubbs engines; but the principal part of my time has been on the 131 class and the 304 class—the old Baldwin engines.
5035. You do not dislike that class? I like them very much. I believe that the Baldwin Company can build as good an engine as any English firm can.
5036. You say that it is not healthy on the new Baldwins;—you mean that they are too hot? Yes; they are too hot.
5037. Mr. Fehon.] Have not push-up engines been used for all trains for many years past? Yes.
5038. That is nothing unusual? Oh, no. As long as I have been at Penrith they have been used.
5039. You spoke of breaking the coil on the tender;—is there not an order saying that that must not be done on any American engine? I believe that Mr. Park has issued an order to that effect.

William Nield, being sworn in, said:—

- Mr. W. Nield. 5040. I an engine-driver on the N.S.W. Government railways.
- 11 May, 1892. 5041. President.] How long have you been driving? About 19 years.
5042. Always in the service of the N.S.W. Government? Yes; I have been about 30 years in the Railway service.
5043. What were you doing before you began to drive? I was in the traffic department for a short time. I have been a gatekeeper; I have been looking after points at Newcastle, and driving a pump; also cleaning and firing.
5044. Where have you been driving lately? For about three years I have been driving between Sydney and Newcastle.
5045. Mr. Brown.] And I can add that he is a very good driver.
5046. Mr. Hoyle.] Did you drive the engine of which the axle broke coming into the Sydney yard? Yes.
5047. That was on the Northern express, was it not? Yes.
5048. You have driven these American engines on the Northern line? I have driven only one of the new Baldwin engines—that is 457—one of the new Baldwin passenger engines.
5049. Will you kindly tell the President and the gentlemen of the Commission your experience of these engines? I like the engine very well; it did the work very easily; but, of course, after the axle broke, we had nothing more to do with it. I think that is putting the thing in a nutshell, and all I can say about it is, that the engine did the work very well, and so I liked it up to that time.
5050. What was your speed? Our average speed was 34 miles an hour, but we would have to do between 40 and 50 miles sometimes in order to keep up that average, on account of easing down for staves and the going up banks. We have to go slowly up the banks, although we do not ease much for them, because they take the banks very fast. But then, as I said before, we have to pick up staves, and sometimes we miss one, and in that case we have to stop in order to pick it up.
5051. Then you were allowed to make up time? According to the rule it is not allowable, but we have to get into time if we can, and we prefer to make up time than to be always writing to explain why we were late.
5052. Have you had any experience of driving on the mountains? I ran for a short time to Katoomba with the tourists on Saturdays.
5053. Not with the Baldwin engines? No; with the Dubbs 'American' or Scotch Yankee.
5054. Do you consider that after your experience of 19 years driving, and your 30 years' experience on the railways, and your experience for I do not know how many years on the foot-plate? About 23 years, a little more or less.
5055. Well, then, after all that experience, what is your opinion about the weight of these engines on the road;—do you consider them too heavy for the permanent-way on which they run? I think not on the Northern line.
5056. Mr. Fehon.] I submit that this is a question of a permanent-way, and an engine-driver can scarcely give an opinion as to the road over which he runs.
5057. Witness.] I merely answer that question because I was not afraid to take the engine over that road again.
5058. Mr. Hoyle.] What weight of rail is there of steel or iron? I do not know.
5059. As a matter of fact, you have not thought anything about the permanent-way at all? No; I never do anything to it—I simply report to some of the men if I notice a slack bit on the road.
5060. But would you consider it safe to run the Baldwin engine over a 75-lb. iron rail?
5061. Mr. Brown.] Is that a fair question? He tells you that he has driven this engine over this road, and that he was satisfied with it, and he further says that he is prepared to drive it over again if the Commissioners desire it.
5062. Mr. Hoyle.] Was this a clean break in the axle, or was it twisted off?

5063. *Mr. Fehon.*] I submit that this question is quite unnecessary, the Railway Commissioners have already admitted that the axles were defective, and that they have been replaced at the cost of the Baldwin Company.

5064. *President.*] Yes, that is admitted, and I do not see what object Mr. Hoyle can have in putting the question.

5065. *Mr. Hoyle.*] Yes, but it has been said that many of the failures have been the fault of the drivers, and that want of lubrication caused the axles to twist off.

5066. *Witness.*] I was sent for by Mr. Thow on the Saturday following the day the axle broke, to tell me that the Commissioners considered it was my fault, and that has not been recalled to my knowledge.

5067. *Mr. Hoyle.*] Did you attend to the lubrication? Yes.

5068. You saw that there was plenty of lubrication? Yes, I attended to it as well as a driver possibly could.

5069. What did you do? As soon as I smelt the hot bearing I stopped, got down, and oiled it, and packed the keep with greasy waste, and went ahead and oiled it whilst running.

5070. Then you did everything that you possibly could? I did as much as though the engines were my own.

5071. *Mr. Fehon.*] You have not been blamed at all for the wheel coming off.

5072-3. *President* (to Witness).] You hear that you have not been blamed for the wheel coming off, and you are not blamed for it now;—does that satisfy you? But it has not been recalled before as far as I know.

5074. It is recalled publicly now at all events. You were satisfied with the engine before the axle broke, were you not? Yes, I expressed myself to some of the officers in that way, and I think to Mr. Stanger. I said that I liked the engine very well.

5075. Did it take curves well? Yes.

5076. *Professor Warren.*] Did it roll? No, not much.

5077. It did not shake you when you took a curve? No; of course we always slow the engine for our own convenience, and for the purpose of keeping the axle-boxes cool.

5078. *President.*] Is there room to work? I have never tried the goods engine.

5079. But in the passenger engine is there? There is room enough for me.

5080. You are a bigger man than the man who said just now that there was not room enough for him.

5081. *Mr. Hoyle.*] That was a goods engine and that would make all the difference.

5082. *Mr. Brown.*] I suppose that the best of drivers must get a hot box occasionally? Oh, well I have seen one on every class of engine I have had.

5083. *Mr. Hoyle.*] Do you drive the Scotch Yankee? Yes.

5084. Were they good engines? Yes, very good running engines.

5085. Did you find that they took a curve well? Yes, but I think they are not quite as easy in taking a curve as the Baldwin engines are; at the same time I like them very well.

5086. They do not throw you off the engine or anything of that sort? No.

5087. *Mr. Fehon.*] I may say that nobody has ever said anything about throwing people off with those engines; indeed, the Commissioners have already said that they considered them very good engines indeed. I might say that the remark I made just now in reference to driver Neild applies to all the drivers. The Commissioners do not blame anyone in connection with what occurred with the Baldwin engines. We think that they took all care, and under the circumstances did the best they could.

Alexander Page, being sworn, said :—

5088. I am an engine-driver on the New South Wales Government railways.

5089. *President.*] How long have you been driving? About eight or nine years.

5090. How long have you been in the railway service? About ten years.

5091. What were you before you were driving? Firing and cleaning.

5092. Were you ever engaged on the railway of any other country? Yes. I was working on the railway of New Zealand before I came here.

5093. *Mr. Hoyle.*] You drive one of the Baldwin engines, do you not, Mr. Page? I do.

5094. Have you driven more than one? Yes.

5095. Driving these Baldwin engines, have you ever had any trouble with them? Yes, I have.

5096. In what respect have you had trouble with them? The boxes running hot.

5097. Have you had any trouble with the reversing gear? Yes, with the reversing gear breaking. I have also had a valve buckle break, and have also had some trouble with the engines slipping.

5098. What engine do you drive—a goods or passenger engine? One of the consolidation goods engines.

5099. What failures have you had with the reversing gear? The back pin connecting the reversing gear broke. That was caused by a very bad flaw in it.

5100. In other words by inferior material? A fracture half-way through.

5101. When you have been driving your engine, going the round after you had finished your journey, have you examined the wheels minutely, and if so, have you ever found any defects in them? I have.

5102. What were they? Broken spokes and a loose tyre.

5103. What engine was that? The broken spokes were on No. 447, and the loose tyre was on No. 496.

5104. Did you report that loose tyre? Yes.

5105. And the broken spokes? Yes.

5106. And is that engine still running? Engine No. 496 is still running.

5107. No. 496 you say was the one with the loose tyre? Yes.

5108. How did you discover that it was loose? After doing a considerable amount of braking the tyre got hot through the brake being applied to the wheels.

5109. And did the tyre then break, or did it merely show that it was loose? It showed that it was loose through the grease coming out between the tyre and the rim when it was heated. When cold no indication of it was perceptible.

5110. Have you ever had any break down with this engine other than the mishaps you spoke of? Any break down—the question is what do you call a break down.

5111. Has anything else gone wrong with the engine? I have had a brake lever draw out of the break shoe.

5112.

Mr.
W. Neild.
11 May, 1892.

Mr. A. Page.
11 May, 1892.

- Mr. A. Page. 5112. Have you ever driven any of the passenger Baldwin engines? Three times. One of the engines was 447, that I have just referred to.
- 11 May, 1892. 5113. Is the 447 a passenger engine? Yes.
5114. *Mr. Brown.*] Is that the one that had the broken spokes? Yes; that is the one that had the broken spokes.
5115. *Mr. Hoyle.*] Did the spokes appear to be broken or only cracked? Well, so far as I could judge by looking at it, the spokes appeared to be broken.
5116. Would you be likely to notice it more when the wheel is hot through the application of the brake—I mean, would the apparent fracture open out then at all? Do you mean the broken spokes?
5117. Yes? Well, I cannot say with this engine whether they would or not, because I had very little braking to do with her. I only ran her once, so that I cannot say.
5118. Did you report that? I did.
5119. And is she still running? Yes; I believe she is still running.
5120. Have you ever had, in hauling your loads, any breaking of the draw-gear? No.
5121. I do not mean breaking of draw-gear on the trucks;—I only refer to the breaking of draw-gear on the engine? I have never had any broken draw-gear on either the trucks or the engine.
5122. Do you run your engine carefully? Yes; to the best of my ability.
5123. You say of No. 447 that there are what appear to you to be broken spokes in the wheel, and that there is a loose tire on engine No. 496? Yes.
5124. *Mr. Fehon.*] You speak about a loose tire;—might not that be after a considerable amount of breaking down the incline? Yes.
5125. Does not that occur in most engines? Yes.
5126. *Mr. Hoyle.*] What, loose tires? I have often seen indications of loose tires on almost all classes of engines that I have driven.
5127. *Mr. Fehon.*] You have mentioned several small breakages that have occurred in these engines;—have you ever driven any new engines before? No.
5128. Are you aware, from your own experience, that these things occur more or less to all new engines during the first month or two of their running? I have seen new engines running hot often before.
5129. *Mr. Brown.*] To whom have you reported these broken spokes? I reported them in the fitters' repair book.
5130. Were they badly broken, or only apparently broken? I would not be certain—they appeared to be broken.
5131. How many of them? Twelve out of fourteen.
5132. Where they fractured right across? Some of them appeared to be fractured right across.
5133. Was this on the driving wheel or the back wheel? The left leading wheel, I think.
5134. *Mr. Fehon.*] Did you sound them? No; I did not.
5135. Would not that have been a better test than looking at them? It probably would; but I reported them for the purpose of being examined.
5136. What did your fitter say;—did not he say that they were broken? I did not hear him pass any remark upon them, but he must have been satisfied that they were all right, because the engine was sent out again.
5137. What is the name of the fitter to whom you reported the matter? Richard Heathcote.
5138. Where is he? In Bathurst.
5139. Has there been any accident to that engine of any kind? Not that I am aware of.
5140. *Professor Warren.*] You say you have been troubled with slipping? Yes.
5141. Very often? Yes; frequently.
5142. But when you have a fine day, with a good road, have you been troubled with slipping? I have had to use sand on a dry road.
5143. *Mr. Fehon.*] That is the engine that you saw at Redfern? Yes.
5144. *Professor Warren.*] Oh, then, we know all about that.
5145. *President.*] Do you mean the engine that we knocked with a hammer, and from whose wheels we took the putty?
5146. *Mr. Fehon.*] Yes.
5147. *Professor Warren (to Witness).*] When you said that one of the engines slipped, did you mean the passenger or the goods engine? I mean that the goods engine slipped.

William Young, being sworn, said:—

- Mr. 5148. I am an engine-driver on the New South Wales Government Railways.
- W. Young. 5149. *President.*] How long have you been driving? For nearly nine years.
- 11 May, 1892. 5150. How long have you been in the service altogether? About eleven years.
5151. Were you firing before you were driving? Yes.
5152. Where are you driving;—what part of the road are you driving on now? Between Bathurst, Wellington, Dubbo, and Cowra.
5153. *Mr. Hoyle.*] Do you drive any of the Baldwin engines, Mr. Young? Yes, I drive a Baldwin engine.
5154. What is the number of the engine that you drive? No. 489.
5155. Is that a Consolidation goods engine? Yes.
5156. Have you ever had any failures with that engine? Yes.
5157. What have they been? Well, I had leaking tubes.
5158. Did they leak badly? Well, on one occasion they were leaking so badly that I had to leave the engine and send for another.
5159. Had you ever any other breakages—failures of the reversing gear, for instance? No.
5160. Or of the brake-gear? Well, no. I had a five-eighths bolt on the end of a stay broke, but it was of no vital consequence.
5161. Do you know whether there is an engine in the Bathurst shop with a valve-buckle broken? Well, I have not been in the shop since Friday, and of my own personal knowledge I cannot say whether there is or is not.

Mr.
W. Young.
11 May, 1892.

5162. Do you know whether the axle of an engine was bent at Orange? Well, I have heard it said. I never examined it. I saw the engine standing on the pit, and was told that it was in consequence of a bad axle, but I did not get down from my own engine to see it.
5163. *Mr. Fehon.*] The man only says that the axle was bent from hearsay. He says that he did not examine it, and still he is asked how it got bent.
5164. *Mr. Hoyle.*] I asked the witness if he had heard as to how it got bent.
5165. *President.*] Then you can call the man who told him.
5166. *Mr. Hoyle.*] Well, my only object in asking the question was to save the Department the trouble of calling an extra witness. (To witness): What other defects did you find in your own engine? I found in the left leading wheel what appeared to be a crack in one of the spokes, and also in the end of the balance weight. That is the spoke on which the end of the balance rests.
5167. Of what material are these wheels made? Well, whether they are malleable cast-iron or by what system they are cast, I cannot tell.
5168. Are the tyres of your engine all right? Yes, so far as I have seen.
5169. Have you had any draw-gear break? On the engine, do you mean?
5170. Yes? No, I have not.
5171. In connection with any of the vehicles? Oh, on the train on one occasion the centre-chain broke.
5172. If the road is in good condition or bad condition can you distinguish it on your engine;—is there any indication of the condition in which the road is by the motion of the engine? Oh, yes; the engine will roll about more on a rough road than she will on a smooth road.
5173. You have had experience of engines before these Baldwin engines arrived—did you find the road in any part rougher whilst you have been using a Baldwin engine than you did before the Baldwin engine began to run? No; I cannot say that I noticed it.
5174. And you say you run from Bathurst to Wellington and Dubbo, and sometimes on the southern road to Cowra? Yes.
5175. Do you run these engines to Cowra? Yes.
5176. And how do you find the Cowra? It is equal to any other road that I run on.
5177. Of course, you have no knowledge of the permanent way? Well, any opinion that I might express about the permanent way would be of no value.
5178. Do you know the weight of these engines? Well, from what I have heard stated here only.
5179. Did you report all the details of the defects in the engine to your officer-in-charge? Well, we make our reports in a book which comes under his supervision.
5180. You have a book then? Oh, yes. There is a book for the purpose, in which all repairs which the drivers consider necessary for the engines are entered by him after he has performed his trip.
5181. Whose supervision is this book immediately under? It is under the immediate supervision of the shed inspector. The leading fitter comes to it and takes from it the repairs that are required by the engine. I believe it will also be under the observation of the District Inspector.
5182. *President.*] It is a book kept in the shed? Yes; a book in which all the repairs which the drivers consider necessary are entered.
5183. Is there a casualty book as well? Yes; the breakages are also reported, but that is more for the purpose of reporting delay to the train—the time the train has been delayed; and, as a rule, the nature of the breakage by which the delay has been caused, is also reported.
5184. And is that entered in your book as well? The casualty book is a different book from the fitters' book. They are two separate books.
5185. At any rate it is not very material. The Commissioners are going to produce all these books, are they not?
5186. *Mr. Hoyle.*] Well I have a little doubt about it. (To Witness): Every casualty is reported in that book, is it not? It ought to be.
5187. At all events you report the matter if there is anything wrong with your engines? Yes.
5188. Do you find that your engine rolls very much? Yes, it does roll a little.
5189. More than other engines? Well, yes it does roll more than other engines, but the lightness of the springs accounts for that. The engine is less rigid than an English engine would be, and consequently in running round a curve a movement is given to it that is more of a swing than I have noticed on any other engine that I have driven. That is a characteristic of the American engine—that is to say, that it rides lighter, and on the whole it has an easier movement.
5190. Have you had any failures at all with the brake-gear? No.
5191. No failure with the brake-gear? No.
5192. Could you keep time with this engine? Yes, everything considered. I may say this, that the engine that I have been running mostly I have had some trouble with in keeping time, in consequence of the difficulty in steaming. That is not a radical defect in the engine, but it is a radical defect in the way in which the repairs have been carried out.
5193. Then have not the repairs that you have reported necessary been made? Well, there have been two attempts to do it, but they have not yet succeeded in making her steam as well as I think she ought to do.
5194. *Professor Warren.*] Those engines do not steam very well then? Well, some do steam very well, but this engine requires a great deal of trouble to make it steam, and I think she burns more coal than she would otherwise use.
5195. *Mr. Hoyle.*] You use the Eskbank coal, I suppose? Yes.
5196. Have you got any slow-down notices in your run anywhere? You refer to bridges and bad places in the road?
5197. Yes; have you either? No.
5198. You have no slow-down notices at all in your road—neither bridges or bad places? No.
5199. *Professor Warren.*] Which is your district? From Dubbo to Bathurst and from Bathurst to Cowra.
5200. *Mr. Hoyle.*] Do you find your engine burns a great deal of coal? Well, I consider that she consumes more coal than she ought to.
5201. That is owing to some defect or other is it not? Yes, it is a defect in my opinion, but you cannot call it a defect in construction. I should not call it a defect for which the builders were responsible.
5202. Is it a defect in design? No; I should not call it a defect in design.
5203. At all events there is nothing wrong that you have been able to discover? Oh, I can find it out, but I can not get it done.

Mr.
W. Young.
11 May, 1892.

5204. *Mr. Brown.*] Perhaps it is cheaper to burn more coal at 2s. 6d. a ton than to get the repairs done? No; I do not know what the reason is at all. The cause of the engine not steaming is because the steam strikes the funnel after leaving the blast or exhaust pipe, and does not dislodge a sufficient quantity of atmospheric air from the smoke box, the result being that the current of air through the fire is insufficient to produce sufficient heat to keep up the required pressure.
5205. *Professor Warren.*] That could be easily remedied? Yes; it could be.
5206. *Mr. Hoyle.*] You say that you have never run any engine but your own? Well, I had one trip with No. 486.
5207. And there was no defect in it? The Crown stays were leaking slightly on that particular occasion.
5208. Have you driven any new engines before? No; I cannot say that I have ever driven engines new out of the shop.
5209. And therefore, you are not in a position to compare the repairs necessary to these engines with the repairs that have been necessary to other new engines? No; I could not venture an opinion.
5210. Do you find any of the bogie axles run hot? No; the bogie axles run very well.
5211. The bogies run well right through? Well, I have had my right trailing engine-box hot, but that was done running from Dubbo tender first. I think that was the reason. I have never had any difficulty with the engine previously.
5212. *Mr. Brown.*] As a driver, what do you think of these Baldwin engines generally? Well, I may say that personally I favour the American type of engine all round.
5213. Yes, but what do you think of this particular type of engine? Well, yes, these particular engines and all other engines built by the Baldwin Company I like, because they are, in my opinion, a great deal easier to ride, and I think a man would live ten to fifteen years longer in driving them.
5214. Well, that is a consideration? I do not know that it is. The English engines, as a rule, are too rigid in the springs, and, therefore, the shaking about that a man's frame is subjected to when he is riding on them is very considerable.
5215. *Professor Warren.*] Do you find these engines hot? Very hot.
5216. Are they hotter than the English engines? Well, they are more confined, but the heat is greatest when still, for when running you can open the front of the cab and get a current of air right through.
5217. At all events they are quite comfortable? Yes.
5218. Still you say you like to drive them? Yes, because they ride easier, and are, consequently, easier on the frame of the driver; at least they are on mine.
5219. But you would not say they are unhealthy? Well, I would not like to say anything about that, because of the heat that a driver is subject to in the summer time from them, but in the winter time, of course, he gets the advantage of it.
5220. *Mr. Fehon.*] You say that these engines are easier to ride? Yes.
5221. Then if they are easier to ride they must be easier on the permanent way than an English engine? Well, that is just what I have been thinking. Of course they are of greater weight than an English engine, but it would take a greater expert than I to pretend to say whether they would be injurious to the permanent way.
5222. Your centre driving wheel is not flanged, is it? No.
5223. Does that make the engine much easier? It ought to prevent grinding on the rails.
5224. Did you take full loads with your engine? I did; more than what is allotted for her sometimes.
5225. So that the defects did not prevent you taking full loads? No, they did not, unless, perhaps, on one occasion.

Patrick Hayes, being sworn, said:—

Mr. P. Hayes.
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5226. I am a ganger.
5227. *President.*] On what part of the line? Between Tarana and Loxton.
5228. How long have you been in the railway service? About fifteen years.
5229. Always in the same position? No, sir; I have been about ten years ganging.
5230. And what before that? Before that I was fettler.
5231. *Mr. Hoyle.*] You are ganging between Loxley and Tarana? Yes.
5232. What rails are on your length, do you know? I have iron rails and steel rails.
5233. How long have you been ganger on that particular length? About five months.
5234. You have been on that length since the Baldwin engines were running? Yes.
5235. Where were you before they began to run? At Brewangle.
5236. They have iron rails there, have they not? Yes.
5237. Since the Baldwin engines began to run, have you had any broken rails? Yes; and I had them before.
5238. But I am not asking you that now. Since they began to run, have you had any broken rails? Yes.
5239. How many? About two.
5240. And before they began to run? Three or four.
5241. Then the lighter engines broke more rails than the heavier ones? The heavier engines have not been on the road so long.
5242. How long were you on the Loxley length? Very nearly two years.
5243. How many rails broke in two years, can you tell us that;—about how many? I expect it would be about thirteen or fourteen broken and cracked.
5244. I do not mean how many rails have you taken out before they were bad rails. I am speaking of rails that have been actually cracked or broken? Yes.
5245. And how many have you taken out of the Loxley length since the engines began to run? Two broken rails.
5246. And how many cracked? Four or five.
5247. That would be seven altogether? Yes.
5248. And you got fourteen in two years with the lighter engines? Yes; that is all I can remember.
5249. Just so. How many broken rails have you had on the length that you are on now since the Baldwin engines began to run, either cracked or broken? Four or five.
5250. That is between Tarana and Locksley? Yes.
5251. Those are iron rails, are they not? Yes.

5252.

5252. Have you had any steel rails break? No; no steel rails have broken.
5253. What are the steel rails that have been recently put upon your line;—are they not 80-lb. rails? I do not know the weight.
5254. They are T rails, are they not? Yes.
5255. Since the Baldwin engines have been running have you had much trouble with your length of the road? No; not much more trouble than before, except in soft places, where it used to go.
5256. Are there any slow-down notices on your length? No; not that I know of. It is a level road.
5257. Have you had many broken chairs since the Baldwin engines commenced to run? No more than I had before.
5258. That is on the Loxley length,—but you had broken chairs and broken rails at both places? Yes.
5259. And have you not found that the road was knocked about more since the Baldwin engines commenced to run than when the lighter engines were running? No; I have not.
5260. Do you know the weight of these engines? Well, I have been told that they are about 100 tons.
5261. You do not know, only what you have been told;—have you noticed since the Baldwin engines commenced to run that the rails have been bent in the joints? Yes; some of them have gone down a little.
5262. Was that a common occurrence before the Baldwin engines came? Yes; it has always been that the joints have gone down a little.
5263. Have you not broken any plates? Yes.
5264. Since the Baldwin engines came? Yes; and before.
5265. Then you do not think that the Baldwin engines are doing the road any more harm than the lighter engines did? No.
5266. Have you had many rails taken out of your length since the Baldwin engines began to run? No more than I had before.
5267. Were these rails taken out before they were very bad? Well, they were badly worn.
5268. Then you have never complained at any time to your officers about the state of the road? Only about these bad soft places.
5269. Have you ever applied to your officers for more assistance to keep these places in order? No.
5270. You never made such a report—never such a request? No; only I have complained to my inspector, but I did not make any report on it.
5271. Do you keep a record of all the rails you take out? Yes; every month.
5272. And that report goes to your superior officer? Yes.
5273. The inspector or the sub-inspector, as the case may be? Yes.
5274. Have you taken out many rails since the Tarana accident? I have taken out rails and turned rails.
5275. *President.*] Since the Tarana accident? Yes.
5276. *Mr. Hoyle.*] Has your inspector travelled over your length since the Tarana accident and marked any rails that ought to be taken out? Yes, sir; he has.
5277. But in the taking of the rails out before the accident you might take a rail out without the inspector's instructions, might you not? I always have been taking them out where they were bad.
5278. Before the accident did the inspector go round and mark them with chalk to show you what to take out; Yes; he marked the rails, and chairs, and fish-plates, and bolts before the accident.
5279. Do you know how many rails you have taken out since the accident? No.
5280. *Professor Warren.*] How many do you think you have turned out since the accident? Well, I expect I have turned and taken out about twenty. I am always doing that.
5281. *Mr. Hoyle.*] Have you taken many rails out on the curve since the accident? Yes, sir.
5282. How often do you take rails out on the curve? When they are required.
5283. But you have just said that you often do it? When they require it I do.
5284. But how often have they required it? It is according to whether they are in good or in bad condition.
5285. And how long ought a rail to be in a curve before it gets bad? Some last longer than others.
5286. Well, with your experience as a ganger, how long ought a rail to be in a curve before it is removed? Well, there are some of the rails that have been there since the first.
5287. *Mr. Brown.*] I think that you are asking him a question that an expert could not answer.
5288. *Mr. Hoyle.*] Well, he says he has taken many rails out; and we know how long a rail ought to last.
5289. *Mr. Brown.*] I have not been able to ascertain it from the time this inquiry began up to the present, Mr. Hoyle.
5290. *President.*] How far are the sleepers apart on your part of the line near Tarana? Well, some of them that I have been measuring are about 2 feet 9 inches apart.
5291. Is that from chair to chair? No; from centre to centre.
5292. *Professor Warren.*] Have you not some as wide apart as 3 feet 1 inch? No.
5293. Have you measured them? I have.
5294. *President.*] Do you know the place where the accident happened—the place where the broken rail was taken up? No; I have not seen it.
5295. Have you not been as far down as there? No; I have not.
5296. *Mr. Hoyle.*] Have you noticed the heads of the rails crushing any more since the Baldwin engines began to run than they used to crush before? No.

John Sloan, being sworn, said:—

5297. I am a ganger employed on the New South Wales railways.
5298. *Mr. Hoyle.*] On what length? At Nyngan.
5299. Where were you employed before you went to Nyngan? On the Brewongle length.
5300. Was your length laid with iron or steel rails? With iron rails.
5301. Whilst you were ganger there were the Baldwin engines running on that length? Yes.
5302. Did you find any broken rails? One.
5303. Since the Baldwin engines commenced to run? They were always running whilst I was there.
5304. But I understand you to say that you found one rail broken since the Baldwin engines were running? Yes; I was only there four months.

Mr. P. Hayes,
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Mr. J. Sloan.
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- Mr. J. Sloan. 5305. Whilst the Baldwin engines were running, did you have much trouble with the rails? No; not more than ordinary.
- 11 May, 1892. 5306. Did the road not give you any trouble at all? Not more than any other road.
5307. You say not more than any other road. Is the comparison between the other roads and this one a comparison between iron and steel. Is the other road you were on, laid with steel rail? Yes.
5308. Mr. Fehon.] And yet he says that he has not had any more trouble with the iron road upon which he is now working and upon the Baldwin engines are running, than he had with a steel rail before they began to run.
5309. Mr. Hoyle.] Yes; I know that. (To Witness): As the roads were of different materials, however, you cannot draw comparisons. Have you ever been on an iron road before? No.
5310. It is a steel road at Nyngan, is it not? Yes.
5311. And you say you only had one broken rail whilst these Baldwin engines were running? That is all; and that was only fractured, it was not broken right across.
5312. Had you many broken chairs? A good few.
5313. On the steel road, there were no chairs, I suppose? No.
5314. It was a T steel road, was it not? Yes.
5315. So you cannot draw any comparison there? No.
5316. Did you have many broken fish-plates? No.
5317. Have you much trouble with your curves? No.
5318. Were your curves strutted? No.
5319. President.] Did you have more trouble with the iron road than you had with the steel road, that you were on before? No more trouble; I only had eight and a half hours work there.
5320. I do not mean that. I mean have you found more damage done to the rails? I have only found one broken rail.
5321. In all your time, have you only had one broken rail? One broken iron rail, and one broken steel rail before that.
5322. Do you find more trouble with the iron road than you had with the steel road? Well, I only had one rail broken in this case.

James Walsh, being sworn, said:—

- Mr. J. Walsh. 5323. I am a ganger on the Government railway.
- 11 May, 1892. 5324. Mr. Hoyle.] On what length? The Tarana length.
5325. From Tarana to where? From 115 miles to 121 miles 40 chains.
5326. How long have you been a ganger? About four years.
5327. I suppose you have been a ganger on other lengths than that? Yes.
5328. How long have you been on this particular length? Since the 24th of December, 1890.
5329. Can you tell me whether you have not had more trouble with your road during the last six months than you had during the previous six months? No, sir.
5330. You have been a ganger on that road since the Baldwin engines began to run? Yes.
5331. Do you find the road in as good a condition now as you did before the Baldwin engines began to run? I find it 70 per cent. better than it was before it was lifted and ballasted.
5332. That is not my question. I want to know whether you find the road as good or better than before the Baldwin engines began to run? It was lifted twelve months ago and reballasted recently.
5333. Do you find the Baldwin engines have any undue wear upon the road. Do you find they draw it out of gauge in any more than any other engine? No, I do not.
5334. Have you got any rails in your road worn to about two and one-eighth on the top? Well, in an iron road some rails will spread a little more than others.
5335. Yes, but I mean away absolutely to the extent of two and one-eighth on the top of the rail where it ought to be $2\frac{1}{2}$ inches? I never put my rule on a rail to measure it.
5336. Is it a fact that you are laying a number of new rails since the accident? I have had no new rails.
5337. Do you say that there are no new rails going into your length? There are no more than usual coming in.
5338. Have you not put any new rails in since the accident? Yes, where the accident occurred.
5339. Have you not put in a number of new rails in other places. Be careful, because I have been there myself and seen the road? They might be new on one side, but they were worn on the other.
5340. Oh, I mean absolutely new rails? There might have been one or two, but I cannot say.
5341. Was there a broken rail in your road last Saturday—a rail with a piece broken off it? Not that I know of.
5342. Well, I know of it because I saw it—a piece broken off like there is there (*tearing a piece out of a piece of paper*)? I have no recollection of seeing it.
5343. Well, I saw it, and it was marked with a piece of chalk. Has the Inspector been along your road and marked the rails with a piece of chalk? No Inspector has been along.
5344. A Sub-inspector perhaps? No, not that I know of.
5345. Who has done it since the accident occurred? I have done some of it myself.
5346. Has there not been a gang of men along this part of the road since the accident occurred? Yes, I was one of the men.
5347. Was there no officer with the gang? Do you mean an officer of the Permanent way Department?
5348. I suppose so. I suppose the Permanent way Department would send an officer with the gang under the circumstances? I do not think so. I did not see any Inspector there.
5349. Well, at whose order was it done? I do not know at whose order, but it was done to get the brands of the rails.
5350. Was there anyone there but yourself? Yes; I was not alone there. There was Mr. Seeman, there along with me.
5351. Was he from Bathurst? Yes.
5352. The foreman blacksmith, you mean? Yes; I think so.
5353. Did he mark any rails with chalk? I do not think so.
5354. Have you had any broken rails taken out since the accident? I am constantly taking out rails when I see them bad.
- 5355-6. But I mean cracked rails? No; I have not taken any cracked rails out since the accident.

5357. Have you had any broken rails taken out during the last few months? There were no broken rails. *Mr. J. Walsh.*
 5358. But I mean fractured ones? Yes; there might have been a few.
 5359. How many? Not more than three.
 5360. Do you not call a fractured rail a broken rail? No; not if it is only fractured.
 5361. Would there be no danger in a fractured rail if a train came over it? No doubt there would.
 5362. *Mr. Brown.*] And that is why he takes them up, I suppose? Yes.
 5363. *Mr. Hoyle.*] Have you had any trouble with the curves on your road since the Baldwin engines began to run? No.
 5364. Have your curves any struts between the cuttings and the end of the sleepers—that is a piece of wood going from the side of the cutting to the sleepers to keep it in position? No; not in my length.
 5365. Have you marked many rails in your length to come out? I have marked several rails. I generally do mark them.
 5366. Was not your gang working last Saturday afternoon till after 4 o'clock taking out rails? Yes; but not for the purpose of renewing them.
 5367. But were they not taking out rails? Yes; but not rails that were marked to be renewed.
 5368. Well, were they turned? No; we were taking out the different brand of rails to see whether they would stand the test, and putting good ones in their place.
 5369. And was that the only thing you were taking them out for on Saturday afternoon? Yes.
 5370. *Mr. Brown.*] Supposing they were taking them out because they were inferior rails, would not that be a very proper thing for the Commissioners to do? Yes, no doubt.
 5371. Is there any part of your road in which the rails are bent? Well, they may nip a little bit.
 5372. Have you noticed it since the Baldwin engines began to run more than before? No; I had to work hard before they came, as I do now.
 5373. Do you think that you had more work before the Baldwin engines began to run than you have now? Yes; I was beginning to think I was going to have an easy time of it. The road was being ballasted and lifted, and there was plenty of help, so we thought it was going to be made easier for ourselves.
 5374. What do you mean by plenty of help? The contractor's men were helping us.
 5375. Was the road in a very bad state before it was lifted? Yes, it was.
 5376. And you find that since the Baldwin engines came there it has been better? Yes.
 5377. It is a good road now? Well, it is passable.
 5378. Have you had many bad rails on your length? There might be an odd one spread here and there but we are always taking them out in the usual way.
 5379. Have you many rails that have been turned? There may be some—yes.
 5380. And when you were putting in these new rails you put in iron rails not steel rails I believe? Certainly not.
 5381. *Professor Warren.*] They are the Eskbank re-rolled rails that you are putting in then? Yes, in the case of rails that are defective.
 5382. *President.*] Can you tell me just where the late accident happened what the distance is between the sleepers? The sleepers on that rail?
 5383. Yes? On the rail that broke do you mean?
 5384. Yes? Well there are eight sleepers on that rail. Some of them are 2 feet 5 inches apart, some 2 feet 7 inches apart, some 2 feet 6 inches apart, and the widest apart are 2 feet 10 inches.
 5385. From centre to centre? Yes, on that rail.
 5386. What is the length of the rail? Twenty-one feet. Some of them have nine sleepers, going round a curve there are nine sleepers.
 5387. *Mr. Fehon.*] With your permission, I was going to ask Mr. Hoyle what time he will finish his evidence, for this reason:—One of our witnesses is an officer of the Baldwin company. We have brought him from New Zealand, and he wishes to get away by the American mail on Monday, otherwise he will be detained another month.
 5388. *Mr. Hoyle.*] I will finish to-morrow evening if I possibly can. I am as desirous as anybody else of finishing the inquiry.
 5389. *Mr. Brown.*] Then, under these circumstances, can you sit on Friday?
 5390. *Mr. Hoyle.*] Yes, I can sit on Friday on this occasion.
 5391. *President.*] We will try to sit on Friday.
 5392. *Mr. Fehon.*] He is a very important witness, because he can give from his own knowledge an amount of information that nobody else in the country can give.
 5393. *President.*] So I understand. We will see to-morrow evening what we can do.
 5394. *Mr. Fehon.*] Well we will ask him to be present so that if Mr. Hoyle finishes in time you might be able to take his evidence then.

THURSDAY, 12 MAY, 1892.

[The Commission met in the Board-room, Colonial Secretary's Office, at 2 o'clock p.m.]

Present:—

F. E. ROGERS, ESQ., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

| ALEXANDER BROWN, ESQ., J.P.

5395. *Professor Warren.*] I desire to state that I have read through the programme submitted to me by the Railway Commissioners for the trial trips of the Baldwin engines to take place on Sunday next. I am perfectly satisfied with the suggested trials. The programme consists first of all in taking a train up the Picton incline with a maximum load of 144 tons, up the 1 in 30 grade, and after that there will be another trial with a lighter load, up the same grade, and then up the 1 in 40 grade a load of 176 tons will be taken, and subsequently a lighter load. Indicator diagrams will be taken all through these trials, so that we shall obtain the actual measurements of the horse-power, and the speed of the engines indicated with stop-watches. It is proposed to obtain the coal and water consumption by taking the precise amount of coal used from Sydney to Picton and throughout the trials and back to Sydney. I do not regard the coal and water test with the same degree of importance as I do the power developed and the load hauled at a certain speed. Mr. Kidd and Mr. Pollock are appointed to take diagrams.

5396. *Mr. Fehon.*] Yes.

5397. *Professor Warren.*] On the trial trip with 144 tons, and also with 176 tons, I wish to have half the indicator cards, and from them I will work out the results, and the Department will have an opportunity of working out the results on their half of the cards. We ought to agree as to the results, and thus put them beyond all dispute. Regarding the engines, I think it will be well to have as few persons upon them as possible, one representative of the Commission and myself and one other person, an assistant who will help me with the gauges; and I shall have to look after the diagrams, and to look after the speed. I do not know whether Mr. Hoyle would like to travel on the engine or not.

5398. *Mr. Hoyle.*] Yes, I should like to go.

5399. *Mr. Fehon.*] There will be a carriage put on, so that Mr. Hoyle can accompany the engine if he wishes.

5400. *Mr. Hoyle.*] Which are you going to try?

5401. *Professor Warren.*] We are going to try the Baldwin passenger engine only at present, and I take it that the trial of the Baldwin consolidation engine will still remain open. The gentleman who will accompany me is a graduate in engineering of our University.

5402. *Mr. Hoyle.*] I have a number of witnesses this afternoon, and the suggestion I would make is this, that without any desire to interfere with the Commissioners at all, as Mr. Rhodes, a representative of the Baldwin Company, and is, I understand, to return to San Francisco on Tuesday next, he might be called this afternoon, as my witnesses will take all the whole afternoon, and perhaps longer; so that if it will meet the convenience of the Commissioners Mr. Rhodes' evidence might be taken now. I am quite agreeable to that course, being aware that that gentleman has been in attendance here for a very considerable time.

5403. *President.*] We could do that if you wish, Mr. Fehon.

5404. *Mr. Fehon.*] I think it would be better not, for I understand that the Commission will sit for a short time to take evidence to-morrow.

5405. *President.*] Mr. Hoyle does not know if he can get through his evidence this afternoon.

5406. *Mr. Hoyle.*] If I must complete the examination of the whole of my witnesses, I may have to continue for some time; but if you say that I shall be allowed to call one witness as a rebutting witness, I may finish to-night.

5407. *President.*] I do not know what there is to rebut. You have given evidence in support of certain charges, and the other side will then proceed to answer these charges. I cannot say at present that there will be anything you can give in reply until I hear what the other side say, but I cannot say anything in anticipation of that.

5408. *Mr. Brown* (to Mr. Hoyle).] Can you sit to-morrow?

5409. *Mr. Hoyle.*] Yes.

5410. *President.*] You do not think you can finish to-day, Mr. Hoyle?

5411. *Mr. Hoyle.*] I do not think so.

5412. *Mr. Brown.*] Well, I suppose we cannot help it—we cannot hurry it.

5413. *Professor Warren.*] I look upon it, if I may say so, in this light: this is a Royal Commission, and you can call Mr. Rhodes at any time you desire; and as it seems unlikely that Mr. Hoyle can complete his evidence, and Mr. Rhodes has to leave early next week, it seems very undesirable that he should go away without giving evidence. He is the representative of the Baldwin Company, and this inquiry concerns the Baldwin engines, and we should like to hear what he has to say.

5414. *Mr. Hoyle.*] I have one important witness to call who is too ill to come to-day. That is the reason I made this suggestion.

5415. *President.*] Very well, we shall see presently what can be done.

Mr. S. S. Pollitzer, being sworn, said:—

Mr. S. S. Pollitzer. 5416. I am a consulting engineer, and have practised for nine years in Sydney, before that I was resident engineer on the railways and waterworks of the South Australian Government, and I was Engineer-in-Chief for the Bulgarian Government for a considerable period. I have been on four or five different lines of railway and have practised as engineer in Hungary. I have taken my degree as a civil engineer at Vienna.

5417. *Mr. Hoyle.*] Are you a member of the Institute of Civil Engineers? Of what country?

5418. Of England? No.

5419. Are you a member of the Institute of Civil Engineers in any other country? Yes; in Hungary.

5420. *Professor Warren.*] What body does that correspond with in England? It is the Institute of Civil Engineers and Architects.

5421. *Mr. Hoyle.*] Have you had much experience in connection with railways? Yes; my experience was about twenty-three years as a railway engineer.

5422. Was it a varied experience? Yes; it was mixed. I have had under my charge, constructed, and surveyed, at least 2,000 miles of railroad.

5423. Then you have a knowledge of the placing of sleeper? Exactly.

5424. And the position of curves? Exactly.

5425. You have a knowledge of these things? I think I have.

5426. *Mr. Hoyle.*] I wish to ask you some questions about the Baldwin engines, Mr. Pollitzer?

5427. *Witness.*] I wish to state to you, Mr. President, that I have had no conversation whatever with Mr. Hoyle, and it was not agreed between us as to what way he should place the matter before me. I think with your permission, that I shall place the case as I think before you, and then you may put what question you like to me.

5428. *President.*] Do I understand that you wish to place your views before the Commission before Mr. Hoyle asks you any questions?

5429. *Mr. Hoyle.*] I am quite willing for the witness to take that course.

5430. *Witness.*] After I have made my statement, any person can ask me what question he likes.

5431. *President.*] Very well, Mr. Pollitzer, you may take the course you suggest.

5432. *Witness.*] I came here with the object of ascertaining whether the Baldwin engines are suitable for the roads of this Colony or no, and stating my views thereon so far as I am acquainted with the subject. This is a most important and serious question that I come forward to prove.

5433. *President.*] What do you mean by coming here with the object of proving anything?

5434. *Mr. Brown.*] I presume that he means he has been called to give evidence.

5435.

5435. *President.*] I understand Mr. Hoyle has called you to state what you think, and not to advance any particular view? Yes. To answer this question I should have to look at it from three points of view; first, *prima facie*, are the Baldwin engines suitable or not for the road. My authority is Professor Rankin, one of the greatest engineers of the day. He says that the weight of a yard of rail should be 12 pounds for every ton the driving-wheel brings to bear on the rail. In this case you have $15\frac{1}{2}$ tons pressure on the driving-wheel, multiplying it by $12\frac{1}{2}$, that gives 195 lb. of rail section, I mean of rail weight per yard. Now, Rankin is a great authority, but I cannot agree with him on that point, because no man would think of making a rail of 195 lb. per yard, and even making a concession of half the amount, is exaggerated; therefore if you have one-half of what Rankin allows, you will have $97\frac{1}{2}$ lb. per rail—that is even taking half. Hence, on the face of it you cannot come to any other conclusion than that the rail is perfectly inapplicable to the engine, or in other words, that the engine is not suitable to this rail. This is only a practical observation, it is not conclusive. Conclusive proof means that I must take a careful cross-section of the rail, and with the utmost precision and accuracy, ascertain the strain on that section for the length of its support between sleepers, and with the maximum weight of the driving-wheel on it. Well, I cannot pass an opinion upon that matter, because no section has been submitted to me, and I have not had a chance of doing it, therefore I am not in a position to pass any opinion with regard to the stability of the rail, or the weight of the engines in connection with it. I should not care to say that it is too heavy or too light, although my professional view is, on the whole, inclined against it, that is to say, I believe, and am under the impression, that if such a calculation were made, it would turn out to be against the Baldwin engine—that is the second point. The third point is to consider the engine in proportion, or rather in connection with the whole roadway. According to my experience, I think this road is absolutely unfit to carry the engine, or what comes to the same thing, the engine ought not travel on that road, and this is to be explained simply by the construction of the permanent way;—how is it constructed? It cannot be otherwise, in consequence of the double-headed rail. These rails are not in any way fastened to the sleepers or properly secured to the permanent way. They are only secured by wooden keys. Now certainly the gang men have their duty to perform, and it is to watch over these keys in their allotted portion of the line; but a key may drop out after the man has passed, perhaps a shower may fall and the wood swells, the sun may come out, and it follows that the wood will then contract, and the key comes out, the rail, which is supported by sleepers 3 feet apart, the rail which is calculated to bear a certain weight in proportion to the distance of the sleepers from each other, ceases to have that support. The condition upon which the weight it could bear was based no longer exists. In the first place it is not fastened, because the key perhaps has fallen out, or the chair may be cracked, and instead of the distance between the points of support being 3 feet it becomes 6 feet, or double the length between the sleepers. That cannot be a proper construction. What I maintain is that in straight lines they are objectionable, these double-head rails with key fastenings.

5436. Do you mean chairs? Yes; they are objectionable in straight lines, and I should not allow any double-headed rail to go into any curve. I might put them in because the curvature of the road was not affected much by the shock of the passing engine. In my opinion these roads should be made capable of carrying these engines. The whole system of the double-headed rails will have to be amended.

5437. *Professor Warren.*] You mean that they should have the ordinary Vignole section, that is the T rail with a flat bottom, and fastened with ordinary dog spikes?

5438. *President.*] Is the rail fastened directly to the sleepers with a spike.

5439. *Professor Warren.*] Yes without any chair.

5440. *Witness.*] Chairs are employed in very sharp curves so as to keep the rail more secure and permanent. The chairs keep the rails in a fixed and permanent position. Now I come to my final statement, which is derived from a great many years of experience. I have been seventeen years in these colonies, and I have carried out railways to a very large extent. Mainly in South Australia, and here I have only had a little to do in that way, such as a person in private practice can have where the railways are in the hands of the Government. Before I came here, seventeen years ago, I never saw a double-headed rail on a permanent way in any main line of railway in Europe. There are no instances in Europe where they have double-headed rails on the main lines, they have cast them out and use them up on the side-ways and stations. Where there is a heavy passenger and goods traffic, no one would think of putting in double-headed rails. The reason is that on account of the keys dropping out, they are unreliable. I have only known double-headed rails to be used in exceptional cases before I came here, as for example at station yards and sidings. When I went to South Australia I saw them for the first time, and when I saw them here I was startled to see that with the advance of science and the safety of passengers in view these rails should still be used. That is in the main what I desire to convey to you with regard to the permanent way of the railways of New South Wales and the Baldwin engines.

5441. *President.*] Are there many double-headed rails made now? Not very many I think.

5442. Why should people make them at all, if they are no longer used? Well I suppose they make them for any Colony that wants them.

5443. I suppose when the Government originally got them they must have been in considerable use and favour.

5444. *Witness.*] They generally think the double-headed rails are the better, because when they are worn on one side you can turn them round, but that is very wrong. People who do not understand exactly the strains acting upon rails recommend them for this sole purpose, but this is perfectly erroneous.

5445. *Mr. Brown.*] Is it not a matter of commercial concern to the people using double-headed rails;—double-headed rails cost more than the T rails, and a portion of the rail lying underground before it is turned over may be subjected to certain chemical action and so on;—has not that had something to do with the change in demand from the double-headed to the T rail? Not quite.

5446. As a matter of economy, is it not much less expensive to lay down a T rail than a double-headed rail with a chair? Yes.

5447. Is not the T rail much less expensive in the construction of the road? Yes, it is less expensive, and it makes a more permanent way.

5448. Well, is not that a reason why the double-headed rail is becoming in less favour than the T rail? Yes, it would be a good reason; but the principal reason is the strain acting on the rail.

5449. *Professor Warren.*] You have quoted Professor Rankin? Yes; he is a very eminent engineer.

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5450. Do you think you have quoted him correctly. You said that if you took 16 tons on the wheel, and multiplied it by 12, you got $12 \times 16 = 192$, or about that, I think you said? Yes; so it would be.
5451. Well, you are taking double the weight—Rankin's rule is with regard to the weight on one wheel? Yes; that is so.
5452. But you have taken it for two wheels? Well, you gave me 15 tons on the driving-wheel.
5453. *President.*] That is on the driving axle, the whole axle.
5454. *Professor Warren.*] Surely you know that a weight of $15\frac{1}{2}$ tons on one axle would be impossible? I certainly drew my presumptions from the weight given in the Press. It said $15\frac{1}{2}$ tons on the driving-wheel.
5455. And you base your evidence on that assumption, and if you presume that one of the Baldwin engines has 15 tons 9 cwt. on one wheel, the whole of your evidence falls to the ground? It does not.
5456. How do you mean? I admit in my evidence that I only gave the half of it.
5457. But you certainly did presume that one wheel of the Baldwin engine had $15\frac{1}{2}$ tons weight on it? Yes.
5458. Well, I can understand you drawing very strong conclusions from it, and I think we should all do so if it were a fact, and say that such engines would be unsafe for the permanent-way? I said distinctly that I took only half of it.
5459. Why did you take half the weight? Because Rankin's rule is a rule only; it is empirical; it is not a mathematical formula, and you agree or disagree with it just as you like.
5460. Rankin's rule on your assumption would be to take 8 times 16, or more correctly, 8 times $15\frac{1}{2}$? Yes.
5461. And that would be about 96 or 97 tons? Yes; about that.
5462. You probably know that Mr. Haycroft gave evidence here? Yes.
5463. You attach some importance to the strength of the rail;—do you consider that it should be treated as a beam? Yes; exactly.
5464. What kind of a beam? A beam fixed at both ends.
5465. Fixed by the two chairs? Yes.
5466. Will you tell me the condition that must be complied with in order to get a fixed beam? Stability. The moment is a factor of the distance of the two supports from the fixed points multiplied into the weight on the beam sitting on it, and divided by a coefficient.
5467. What is the bending moment for the point? W.L. 4 would be the bending moment over the pier for the fixed beam—that is, for a beam actually supported at both ends.
5468. And loaded how? In the centre.
5469. Yes; that is right.
5470. Now, why do you take this as a fixed beam? Well, you have a beam and two chairs, and these two chairs are fastened by two heavy bolts to the sleepers, and thus the rail is made tight.
5471. Very well; I do not say it is a fixed beam, but I wanted to have your reasons? I am here, and subject to examination. You have these rails with the chairs into which they are wedged, thus the rail is made immovable.
5472. That is, supposing the chairs are rigid, and the keys are driven in tight?
5473. Then you think it would be just the same as a beam driven into a wall and with a heavy weight on it? Quite so.
5474. If that is your assumption you are right upon it. But the question is the value of the assumption. (*Witness*): If you raise any objection or question to the assumption, then how can you say the rail is over the whole. A rail over the whole of the sleepers is a continuous girder. The rail represents nothing else than a fixed girder over so many piers.
5475. On what theory do you base your statement that it is a continuous girder; what conditions must be complied with to make it so? It must be one piece over all the sleepers.
5476. What about the supports? If the girder is one long stretch, and all the piers which are between the ends are to prevent the bending of the rail, those points are where the continuous girder is supported.
5477. And that is all. What conditions must be complied with in order that you may treat a girder as continuous? Will you kindly explain to me what you want me to answer.
5478. Supposing that the sleeper is depressed, and that the supports are not of the same length, what becomes of your theory? It still holds good.
5479. Without modification? Yes, without modification it still holds good.
5480. I am surprised to hear it? The pier must disappear if it has settled a little, the elasticity of the girder will come down.
5481. It would not interfere with the point of contraflexure, and the bending moments all through? It would alter.
5482. The evidence is remarkable up to the present time. Continuous girders are well understood, and I can call the Engineer for Bridges and Mr. Deane on this matter. Supposing then that in the case of a rail on several supports, one of the supports should be depressed, would that alter the positions of the points of contraflexure? Yes; but it will still remain a continuous girder, and the points of contraflexure will be different from what they were before.
5483. You admit then that if the points of support are altered there will be a difference between the points of contraflexure? Yes; but it is still a continuous girder.
5484. Then it would be a very dangerous affair. If one pier happened to be depressed, what do you say would then happen? Oh, it dips down with sleepers, you must keep the sleepers up to the permanent level.
5485. I daresay we shall have evidence that will show the value of treating the rail as a girder or a continuous or fixed beam. Do you know what a bull-headed rail is? I do not know any rail by that name.
5486. It has a larger head than other rails, and it is fastened with keys the same way as a double-headed rail? Perhaps you will draw me a rough section? [*A rough diagram is shown to witness.*] I have seen these rails very little used.
5487. It is fastened exactly in the same way as double-headed rails;—would you apply the same remark to it as you have the double-headed rail? With regard to the permanent-way?
5488. That is what I mean? Yes, I would.

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5489. You would say that a rail that is fastened by keys and chairs in the same way as a double-headed rail would be equally bad? Yes.
5490. Your experience is mainly Continental? Yes, and Colonial.
5491. You say that on the Continent the Vignole rail is almost universally adopted, and that I think is so as far as I can learn, and you look upon a rail supported by chairs and sleepers as exploded? Yes.
5492. Would you be surprised to know the double-headed rail is almost in universal use in England, and that the Vignole section is not used to any such extent? It may be so.
5493. And you still say that it is an exploded idea? Yes.
5494. You admit, I suppose, that there are some engineers in England, such for example, as Baker and Fowler? Oh yes.
5495. And you admit they would know something about it? Yes.
5496. On the London and North-Western they have nearly all bull-headed rails, and they have chairs and sleepers? Oh yes, that may be.
5497. Still you come here and give evidence saying that the double-headed rail with a chair and keys is an exploded idea? Yes.
5498. And yet nearly the whole of the English lines are laid with it? Professor Weber says that a double-headed rail, no matter what shape or construction it may be, is not by far to be compared in resisting a strain, or in durability with the Vignole.
5499. I think it ought not to go through the Press that the system of rails adopted in the Colony is an exploded idea, without it being known at the same time that that system is universal in England? It is impracticable and dangerous to every curve. I cannot disassociate myself from that idea.
5500. And yet the English engineers are competent men? Oh yes, I have personal friends among them, and they are as clever as any engineers in Germany or Austria.
5501. Well, we will let it stand as a matter of opinion.
5502. *Mr. Brown.*] Continental as against English engineers?
5503. *Witness.*] On the Continent you will not find any double-headed rails.
5504. *Professor Warren.*] You approve of the Vignole section simply because it has no keys? Yes; the main objection to the double-headed rail is because it is not a permanent fixture to the sleeper.
5505. You said no man would venture to put in double-headed rails, because the keys would fall out; you surely made that statement without a knowledge of the English practice? I have not much knowledge of the English practice, and if I make a statement of any kind before the Commission it is in connection with my experience on the Continent and in the colonies.
5506. I do not think you would find your fellow countrymen so enthusiastic about the merits of the Vignole rail? Well, Professor Weber admits it.
5507. Admitting that you have double the weight on the wheels, you still hold that the Baldwin engines are unsuitable for the permanent-ways of this Colony? Yes. I simply go by the empirical rule of Rankin.
5508. Then, because Rankin's rule gives 96 lb. per yard, you say these are unsafe? Yes.
5509. In applying the rule did you merely look at the strength of the rail? I looked at the strength and the durability and the cheapness.
5510. In order to satisfy the durability what did you require in the rail beyond what is necessary for the strain; did you require better materials? Yes; either that they should put better material or more material into it.
5511. Do you allow a margin for wearing down so that the strength of the rail should be calculated for when it is worn down? It should be calculated for the maximum strain that is to go on it.
5512. Is it not a fact that rails are often made heavier than necessary to allow for wear? Yes.
5513. Heavy rails are made where lighter would do, simply for economy—that is, lighter rails would carry the load but would wear out sooner than the large ones? Yes.
5514. How do you make the strain calculation of a rail? The strain calculation of a rail is obtained by its weight; then you must add a certain percentage for wear and tear, that is, for the use of it.
5515. *Mr. Hoyle.*] Have you had any experience of the New South Wales rail? Very little.
5516. Do you know the weight of the rail here—the iron rail? No.
5517. It is 75 lb. to the yard. I want to ask you whether, taking into consideration the way the sleepers are placed from centre to centre, and that they are from 2 feet 4 inches to 2 feet 9 inches apart on the curves, and from 3 feet to 3 feet 4 inches on the straight, do you consider it safe for a Baldwin engine with a weight on the driving-wheel of 15 tons 6 cwt. to travel over a straight road at 40 miles an hour and round the curves at 25 miles an hour? Well, I do not care to answer that question. It comes to the same thing as I said before. It can only be answered definitely by calculation. My superficial impression is that it would not, but to give you a definite answer I should require to make my calculations. To give you merely an impression would be to place me in this position, that I might just as likely be wrong as right.
5518. You have not made such a calculation? I have not made it; I have not had the opportunity of doing so.
5519. From your experience of rails, where you have found fracturing or breaking, did you find it more in the case of lateral than perpendicular fractures or breaks? The centrifugal force you mean. I think it will be the perpendicular pressure on it.
5520. And not the lateral strain. It will assist it perhaps, on the curves? Well, it is only a question as to the curves, because the centrifugal force can only occur on the curves.
- 5521-2. You say you have had very little experience of double-headed rails? Well, I have had nothing to do with them. I am frequently employed at work on the Blue Mountains, and I have seen on the curves there long logs driven in against the sleepers on the side of the cutting.
5523. You mean struts? Yes; that shows the action of the engines on the rail. The action of the engines shoves the rails out. You have to keep them in by these logs of wood. On a well made road that would not be needful.
5524. With a T rail of the same weight these struts would be necessary also? [Not quite; it might be necessary, but the shocks and bearing out of the rails occur from the loosening of the keys, and then the tangential force has more power to force the rail outside. On the other hand, if the rail is fixed, it would tend to greatly reduce it.

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5525. You think that the effect of the keys coming out of the chairs causes a liability of the road spreading? Exactly.
5526. And that would be a dangerous thing in itself? Oh, yes.
5527. *Witness.*] I want to refer to the two photographs hanging in this room. Yesterday I had an opportunity of carefully examining them. If you look you will find that these engines are photographed on Vignole rails, and the Baldwin engine people themselves would, I think, admit that they would prefer to run their engines on the Vignole rail instead of the double-headed rail.
5528. *Professor Warren.*] There is a difference between saying one thing is better than another from saying that it no use whatever;—you say the double-headed rail is an exploded idea? Yes.
5529. You said no man would venture to put in double-headed rails because the keys drop out, and that applies to the bull-headed rails? Yes.
5530. It is not a question then of their comparative merits, but whether one is any good at all or not? It is a question of fastening the rails to the structure.
5531. *Mr. Fehon.*] You have had a lot of experience of iron rails, I understand;—will you look at that one? [*Witness here examined the rails from the scene of the Tarana accident.*] Is that a good rail or a bad one? I should not care to express an opinion. The break is pretty old—there is a black spot upon it.
5532. I mean the rail as a whole? On one side it looks first-class, and on the other I should say it was very bad.
5533. What drop test should that stand, dropping from the height of a foot, before breaking the rail? I should think about 18 tons.
5534. You should think it would stand 18 tons dropping 1 foot? Yes.
5535. With a long experience of rails? Yes.
5536. You say you have been in the colonies seventeen years;—what have you been doing all that time? I have been conducting business when I could get it to do.
5537. You have not been in any regular employment? No; I am consulting engineer.
5538. You were employed by the South Australian Government? Yes.
5539. For how long? For seven years.
5540. What have you been doing since that time? I was employed on all kinds of engineering works.
5541. What are you doing now? Nothing; because there is nothing to do. I am not so fortunate as to have a billet like some men.
5542. You were speaking of your French experience? Yes.
5543. What weight of rail do they use there? The outside is 75-lb. rails.
5544. Would you be surprised to hear that they are now using 67-lb. rails, and that they run a 98-ton engine over these rails? It does not surprise me; it depends upon how far you put your sleepers apart.
5545. You have given us a lecture as to how our permanent-way should be built? I have not given any lecture; I was asked to give my opinion, and I have given it.
5546. There was another gentleman here who had had ten months' experience, and he gave us his opinion as to how we should construct our permanent-way? Well, with ten months' experience, no doubt he was a far superior man to me.
5547. You spoke of the road spreading;—have you known any accident to happen in New South Wales from the road spreading? That has not been my business; I am not reporting the accidents on the railways of your country.
5548. Have you heard of an accident occurring through the spreading of the road? No.
5549. Well, this is only theory on your part? It is practice.
5550. Did you give evidence at the Cootamundra accident against the railway? Yes.
5551. That was the last time you appeared at any of these investigations? Yes; I think it was.
5552. *Mr. Hoyle.*] There was no Baldwin engine there.
5553. *Mr. Fehon.*] Do you not think a trip to the old country would do you good to freshen up your knowledge? I daresay; but I think I should recommend it to you as more appropriate than to myself.

David Dunbar being sworn, said:—

Mr.
D. Dunbar.

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5554. I am manager of the railway works from Bathurst to Bourke; I was employed by Mr. Proudfoot on the 13th November, 1890, to undertake the relaying and reballasting the line from Bathurst to Bourke.
5555. *Mr. Hoyle.*] You say you were manager for Mr. Proudfoot? Yes.
5556. How long have you been in his employment? Since the 13th November, 1890.
5557. Did you have much experience before that? Yes; I had about thirteen years experience altogether. I first started work near Blayney, and I worked right through on the construction of the permanent-way to Nyngan; from there I came down to Strathfield, and was employed by Amos Bros. as foreman on the line—laying the Hawkesbury and Newcastle ends; then I was employed to lay the permanent-way for 13 miles between those sections,—the whole length of the sections was about 100 miles; before that I was employed by Messrs. Halliday and Owen from Narrendera to Jerilderie.
5558. Then you have a general experience of the rails of this Colony;—have you any experience where iron rails have been in existence? My only experience was from Bathurst on to Orange.
5559. That was with T rails? Yes; they were iron T rails.
5560. Are they all there now? No; they were all relaid with steel 70 or 71 lb. to the yard.
5561. Have you been on the road since the Baldwin engines have been running? Yes.
5562. Can you tell us whether, in your opinion as a plate-layer, these engines are having any injurious effects on the roads? They do not show it any more than the heaviest of the other engines. On my section the joints are down a bit. They are the only places which show a weakness, and that is because the sleepers are placed too far apart at the joints.
5563. If the sleepers were placed sufficiently close together would a 71-lb. steel rail be sufficiently strong to carry these engines? Yes.
5564. In consequence of the oscillation of these engines is the road thrown out of gauge? It may be if there are bad spots in the road, but if the road is well ballasted I do not see that that would throw it out.
5565. Do you think if we had bad weather and long rains on your length that the Baldwin engines would be perfectly safe? It all depends on the foundation under a road. If there were plenty of good ballast under the road it would be all right. No doubt it would go down more in wet than in dry weather.

5566.

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5566. Is there plenty of good ballast there? Yes, in parts. They are only ballasted to 6 inches under the sleeper from Bathurst on.
5567. Are there any places where that does not exist? Well, as the rolling stock comes over it of course it comes down, but I do not suppose there would be that now.
5568. Is the road in your district wavy? Yes, on account of the joints. I suppose there are 50 per cent. of the joints that are down more or less, and that makes it look wavy.
5569. Do you think that the joints coming down is caused by the great weight of the engines—I mean the Baldwin engines? Yes, it is caused by the heaviest of the engines; the Baldwins and others.
5570. It is the Baldwin engines that are under consideration;—do you consider that the weight of these engines, taking into account that they are considerably heavier, about 8 tons, I think, in the passenger, and about 18 tons in the Consolidation, have an injurious effect upon the road?
5571. *Mr. Fehon.*] I ask if that is a fair question. Mr. Hoyle put a question whether any injury was caused to the road by the weight of the engine, and the witnesses answered the heaviest of the engines—Baldwin and others. I submit that it is not the weight of the engine that has to be taken into account, but the weight on the driving-wheel.
5572. *Mr. Brown.*] I thought the term a scarcely fair way of putting it, and I thought some objection would be taken.
5573. *Mr. Hoyle.*] I only want to get at the truth;—if the truth is elicited I am perfectly satisfied;—as the weight of the driving-wheels of these engines is 15 tons 6 cwt. on the one driving-wheel, and 15 tons 9 cwt. on the driving-wheel of the other, do you think that weight would have a greater effect upon the joints of the rails placed as the sleepers are than a lighter weight would have? The more weight there is upon any one pair of wheels would put the joints down—the heaviest weight would put it down.
5574. And you say the ends of the rails are down at the joints?
5575. *Mr. Brown.*] Is it not fair to say that there are other engines with heavier weight on the driving-wheels on the line?
5576. *Mr. Hoyle.*] Not on that road.
5577. *Mr. Fehon.*] There are engines within 3 cwt.
5578. *Mr. Brown.*] That is a fair way to put it to him. The Commissioners say that there are some engines on the same line within 3 cwt. of their weight, you should ask him if these engines—the Baldwin engines—are heavier on the road than other engines of a similar character.
5579. *Mr. Hoyle.*] No doubt Mr. Fehon is in possession of information that I have not got, in fact there are no papers before me, although it has been stated several times that these weights would be furnished to me.
5580. *Mr. Brown.*] That, I think, is not the fault of the Railway Commissioners.
5581. *Mr. Hoyle.*] The Commission, so far as I am concerned, will to-day be over, and I have not had the opportunity of seeing these papers before me, and if it were not for the courtesy of Mr. Fehon once or twice, I would not have known the weights at all.
5582. *Mr. Fehon.*] The diagrams have been on the table all through the inquiry.
5583. *Mr. Brown* (to witness).] Presuming that there are similar engines, or within about 3 cwt. of the same weight as on the driving wheels of the Baldwin engines,——
5584. *Mr. Fehon.*] The exact weights are, I think, 15 tons 1 cwt. on the Mogul and 15 tons 6 cwt. on the Baldwin.
5585. *Professor Warren.*] Do you say that the Mogul weighs that?
5586. *Mr. Fehon.*] Yes; the Scotch Yankee.
5587. *Professor Warren.*] I think you mean Beyer and Peacock's Mogul?
5588. *Mr. Fehon.*] I think it is the Dubs engine.
5589. *Secretary to the Railway Commission.*] Yes; they are called the Scotch Yankees—426 class. They were obtained about 1889.
5590. *Mr. Brown.*] Well, considering that the Baldwin engines are only about 4 cwt. more than the others, do you think that they would be more injurious to the road? Yes, they are of course the heavier weight, and a heavier weight upon one pair of wheels must be more injurious to the road.
5591. Do you think the Baldwin engines are perfectly safe on your section? Yes, they are.
5592. Has your road been reballasted lately? Part of it.
- 5593–4. And is now in what state of repair? It is in splendid condition, or rather that portion which has been resleepered and reballasted.
5595. What is the width of the sleeper from centre to centre on what you have done? The width is 10 inches at the joints, the next sleeper is 2 feet 6 inches, and the remainder are 2 feet 7 inches.
5596. Then 2 feet 7 inches is the greatest width? Yes.
5597. *Professor Warren.*] What weight of rail is that, is that a 71 vignole section? Yes.
5598. Have you any experience where an iron road has been laid and sleepers placed further apart? Very little.
5599. *Mr. Hoyle.*] Do you think it perfectly safe for that road—I mean the iron rails? I do not know how far the sleepers are apart, and so I could not say.
5600. Say that the sleepers are 3 feet apart on the straight, and 2 feet 8 inches to 2 feet 9 inches on the curve, with an iron rail 75 lb. to the yard? I consider that the joints, where they are coupled with the fish-plates, are the weakest part of the road. The sleepers are 2 feet 8 inches and 2 feet 9 inches apart on the curve, but that is not at the joints; they are nothing more than 10 inches at the joints.
5601. *Mr. Fehon.*] Do you know the engine called the Vulcan? No; I do not know it by that name.
5602. Some engines are harder on the road than others;—is not that so. Would an engine with a rigid wheel base knock the road about more than a pliable engine? An engine with good wheels and springs could not knock the road about.
5603. And suppose an engine has one of the driving-wheels without a flange, and there is no lateral pressure at all;—would not that be easier on the road compared to an engine that has a flange on all the wheels? That—I mean the engine with flanges on all the wheels—would be harder on a curve than the other.
5604. Instead of three flanges gripping the rail, you would have only two? Yes; two flanges should be easier than three.
5605. Have you noted that the Baldwin engines have only two? Yes; I have noticed

- Mr. D. Dunbar. 5606. And do you not think they would be more easy? Yes.
 12 May, 1892. 5607. *Mr. Brown.*] So far as you know, are these Baldwin engines suitable to the permanent way of New South Wales? Yes.
 5608. And in your section, with the exception of the joints, you find nothing wrong with the road? No; except in the case of the joints—they are a little weak.

Frederick Elliott, being sworn, said :—

- Mr. F. Elliott. 5609. I am a driver at Penrith, and drive between Penrith and Bathurst. I have been driving for about twelve years, but I cannot be sure to a month or two of the time.
 12 May, 1892. 5610. *Mr. Hoyle.*] Have you driven a Baldwin engine? Yes.
 5611. What class of engine have you driven? Both passenger and goods, but the goods the most.
 5612. What are the number of the passenger engines you have driven? Nos. 452 and 457, passenger engines.
 5613. Was the number 457, the engine that was in the accident at Tarana? Yes; I believe it was.
 5614. Did you drive 452? Yes; I have driven eight different American engines altogether up to the present time.
 5615. Can you tell us whether, whilst you have been driving these engines, you have had any trouble with them? No; not with regard to breaking down, except for brake handles for the tender.
 5616. Have you never had any failures of the reversing gear? No.
 5617. Or the brake-gear or tubes? No; only the screw that takes the brake up, that was bent with me, but there has been no accident with the brake itself.
 5618. What caused that to bend, was it through weakness? I think it is on account of not being counter sunk, some have been counter sunk, and they have never bent since.
 5619. Would it bend through the result of want of care on your part in handling your brake? No; I think not.
 5620. Did you handle it with all the care you ought to? Yes; it was through it not being counter sunk.
 5621. To take the end of the screw, you say? Yes.
 5622. Have you had any leaking tubes? No.
 5623. Then, so far as you are concerned, your engine has been perfect? Yes; with the exception of some of the ferrules coming out of the tubes, but they never leaked.
 5624. You mean they came out when you have been cleaning the tubes? Yes.
 5625. Have you ever minutely examined the wheels of these engines? Yes; I always examined them on coming home from trips.
 5626. Have you seen anything the matter with them? No.
 5627. No defects in the wheels of No. 457? Well, there are holes in them from the casting when they were made.
 5628. Do you say there is nothing in 457? I have seen what appeared to be cracks in them, but I would not like to swear that they are cracks.
 5629. Did you scrape the paint off? No.
 5630. You had only a look at them? Yes.
 5631. They might be marks of welds? Yes; they looked like cracks, but I could not say that they were. I cannot say throughout, anyhow.
 5632. How did you find these engines take the curve? So long as you go cautiously they take the curves very well.
 5633. What do you mean by cautiously—about what rate of speed do you go when taking curves? On a passenger engine, I went about 20 miles, or a little over. Around a curve I should go comfortably.
 5634. You would not attempt to go beyond 20 miles an hour? No; not round an 8-chain curve.
 5635. Would you go 20 miles an hour round an 8-chain curve? Yes.
 5636. And you find that the engine takes it perfectly? Yes.
 5637. Easy? Yes; that is going into it.
 5638. You have been driving other engines before these Baldwin goods engines? Yes.
 5639. Have you driven the Scotch Yankee? No; she is passenger.
 5640. Have you driven the Consolidation, which is nearly equal in weight—what is called the old Consolidation, the old American engine—have you driven those? Yes; a good many times over the mountains.
 5641. Having driven the American engines and now the Baldwins, do you find that the road, and particularly where iron rails have been laid, any worse than before? I do not think so.
 5642. You found no extra motion with your engine indicating that there are bad places? I do not think so any more than before, some places is better.
 5643. Have you any places where you would slow down on the road? Yes.
 5644. I do not mean on the bridges, but where else are there places on the roads where you have orders to slow down? It is only on the bridges, and where they are relaying.
 5645. When you were driving the passenger engines did you use Helensburgh coal? That is only for the mail.
 5646. Then you used ordinary coal? Yes.
 5647. Do they steam well? Yes, now very well, they have been altered, and now they steam very well, at least they did so when I was last on them.
 5648. Did you find when driving the American engines that they were rough on the curves? The old ones.
 5649. Yes? Well, I should sooner drive the old ones than the new ones, I should consider myself much safer.
 5650. Do you consider them easier on the road than the new ones? Yes, that is my opinion.
 5651. Have you ever used the Vulcan? No, I do not remember.
 5652. In comparison with the larger American engine, did you find the coal consumed by the Baldwin very much greater? Well, we used more coal on the new than on the old ones.
 5653. Much? Well, about 10 to 15 cwt. on the trip, perhaps about a ton—that is, from Penrith to Bathurst and back; I think that would be about it.
 5654. And now about the loads you haul; what loads do you take up the Lapstone? I never took a passenger train direct from Penrith; I have taken it from Katoomba.
 5655.

5655. Do you run in then with the mail? Yes, I only went two trips.
5656. Well, in the case of the trips you have driven; in taking your goods train from Penrith to Katoomba, are you always assisted? Yes.
5657. By a push-up engine? Yes.
5658. And they come back light from Katoomba often? I am not in a position to say whether trains come back light from there very often, but I have shoved up myself and I have come back light.
5659. In your case, where you have had to shove up behind, have you oftener come back light than with a load? I do not think so.
5660. Have you any doubt about it? Well, I have not shoved up much for nearly two years, I have generally been in front, but I have come back light.
5661. As often as with a load? Yes; I think about equal.
5662. *President.*] Why is that so.
5663. *Mr. Brown.*] Because he had not anything to carry I suppose.
5664. *President.*] But what bearing has that upon this inquiry whether you have come back light or not.
5665. *Mr. Hoyle.*] It is a question of economy, the contention is that having larger engines such as these they can take larger loads, and I ask whether if they have to come back light it is any economy at all.
5666. *Mr. Fehon.*] It is a question upon a matter which is scarcely in issue, what this inquiry has to determine is whether the Baldwin engines are fit for the road and the road fit for the Baldwin engines.
5667. *President.*] I see what you mean now, Mr. Hoyle, but at first I did not see how coming back light was material, and as it affects only a matter of economy, I do not see still how it is material with regard to what we have to inquire into. But of course the pushing up is material.
5668. *Mr. Hoyle.*] Do you know the weight on your engine or the weight on your driving-wheel? It is 15 tons. 9 cwt., I think.
5669. What load did you haul up from Penrith unassisted? The greatest was twenty waggons loaded.
5670. That is 10 tons a waggon? Yes.
5671. So that it was equal to 200 tons? Yes; I think it was made up of seventeen waggons and one large brake-van and a small brake-van.
5672. *Professor Warren.*] Well, that is equivalent to twenty vehicles? Yes.
5673. Have you had any draw-gear break? Yes, the draw-hooks and centre chains on the trucks.
5674. But on the engine? No.
5675. And when you take a load of that kind up unassisted you take up an extra brake-van for the purpose of protection, and when you take a shove-up engine you do it for the purpose of assistance? Yes.
5676. *Mr. Fehon.*] The push-up is really a brake, having regard to the power required to assist the trains.
5677. *President.*] In case anything should give way, I suppose.
5678. *Mr. Brown.*] It is quite evident you never had a conversation with this witness, Mr. Hoyle.
5679. *Mr. Hoyle.*] I have never had any conversation with any of these witnesses.
5680. *Witness.*] I have not had any conversation with Mr. Hoyle about this matter.

Mr.
F. Elliott.
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Patrick Dwyer, being sworn, said:—

5681. I am a ganger in the employment of Mr. Proudfoot, working on the section between the 105 miles and the 128 miles on the Western Line.
5682. *President.*] Is Mr. Proudfoot working on this line?
5683. *Mr. Fehon.*] He had a contract under the Commission for relaying and putting the line in a better order.
5684. *Mr. Hoyle.*] Where is the 105 miles and 128 miles? Between Wallerawang and Bathurst.
5685. Have you had in your capacity of ganger a practical knowledge of the line, have you walked the lengths where your works are carried on? Yes.
5686. Were you ganger when the road was reballasted between Sodwalls and Tarana? The old road?
5687. Yes, I mean the old road? Yes.
5688. Do you consider that that part of the road near Sodwalls, where there are iron rails now is perfectly safe for the heavy traffic going over it? No, I do not think it is.
5689. *Mr. Fehon.*] The witness asked if the old road or the new road is meant, I think you should define a little more clearly that it is the old road you mean, as for the new road it could not be better.
5690. *Mr. Hoyle.*] Did you have a knowledge of the road before it was lifted? Are you speaking of the old road?
5691. Yes, that portion which was not lifted between Sodwalls and Tarana? No, I had not.
5692. Were you on the work when it was lifted? Yes.
5693. Since it has been relifted and reballasted, is it your opinion that taking into consideration the lifting and reballasting the road is perfectly safe for this heavy traffic to go over it? I do not think so.
5694. Why? Because the joint sleepers are too far apart in the first place.
5695. Does that apply on the curves only or on the straight? Both on the straight and on the curve.
5696. Whilst you were relaying by the instructions of the Commissioners, will you tell me what spacing between the sleepers was carried out in that new work;—what was the spacing? Ten inches the joint sleepers from the centre, that is, first from the joint; then 2 feet 6½ inches the second sleeper, and 2 feet 7 inches right through the length and on the curve.
5697. *Professor Warren.*] That is what you are doing on your contract? Yes, on the new works.
5698. What is the spacing on the road you are now reballasting; on the old road that you lifted;—what is the spacing there? I never lifted any old road.
5699. Well, that portion of the road which is being reballasted;—how are the sleepers placed there? The joint sleepers are 10 inches, or, perhaps, 11 inches, on one side, and 18 inches, perhaps, on the other side.
5700. At the joint—that is 28 inches between the centres and the sleepers? Yes.
5701. With the joint between? Yes.
5702. *Mr. Hoyle.*] And you think it should only be 20 inches? Yes.
5703. *Professor Warren.*] You think that 10 inches joint and 2 feet 6½ inches and 2 feet 7 inches are all right and would carry the Baldwin engines? Yes, I think so, in safety.

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P. Dwyer.
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5704. *Mr. Hoyle.*] Do you know whether the engines which were running over the road previous to this were too heavy for it. It appears there had been engines running over these roads with only 4 cwt. less than the present Baldwin engines;—do you consider that these Baldwin engines, which are heavier than the previous ones, knock the road about more than the others did? I cannot say. I might give an opinion if I had travelled on them, but I have not.
5705. Then you have not travelled on the Baldwin engines at all? No.
5706. Do you know anything about the bridges? No.
5707. Have you found in your experience that the sleepers placed in the old road had a tendency to spread? Yes; I think they would.
5708. When you were reballasting these lines did you find many chairs and keys broken? Yes.
5709. How many chairs? Sixty per cent.
5710. Sixty per cent? Yes; sixty out of 100 of the chairs, that is on parts of it, were broken.
5711. Would those parts be on the bad road—that is, on the road that was relifted twelve months ago, when you reballasted the road. I understand you to say that you found this number of broken chairs? Yes; when I was relaying.
5712. You are now referring to the relaying at Sodwalls? Yes.
5713. And you say that you found as a rule about sixty out of 100 chairs broken? Yes.
5714. Did the Baldwin engines run over that portion before the relaying took place;—Are you speaking of the section from the 113 miles 30 chains to the 114 miles 60 chains? Yes.
5715. When you were reballasting the other portion of the line did you find many chairs broken there? Yes, I did.
5716. Did you find in picking out your line any broken rails? No; I did not.
5717. You did not find any cracked rails? No; but I have seen men from the gangs take broken rails out.
5718. That was before? Before I came to the part of the road that I had to relay.
5719. But was it on that portion of the road before you relaid it that you took these rails out? Yes.
5720. When you were taking out the old rails, and putting in the new ones, did you find any of the old ones broken? No.
5721. Where did you get the two broken rails from? About one-half mile ahead of where I was relaying. The flagman came back and told the inspector that there was a rail broken, and that there was no repairer to put it right, so that I had to send a couple of men back to relay it.
5722. Have you taken iron rails out anywhere else, and relaid the line with steel rails? No; I have not.
5723. So that you cannot say, from your experience, whether you found broken rails anywhere else? No.
5724. Now, can you tell me what is the condition of the rails generally between Sodwalls and Tarana—that place that you ballasted, but did not relay? They are in very bad order.
5725. Have you been on the job recently? Yes.
5726. When were you there last? I was there nine weeks ago.
5727. And you say that the rails then were in very bad order? Yes.
5728. Did you find that many of the rails, when you were re-ballasting, were turned rails? Yes.
5729. What is your experience, as a fletcher; do you find that a rail that has been turned is more easy to fracture than a rail that has not been turned? Well, it all depends on where it is put in. If the sleepers are the same distance apart, and they do not the rail, it might make no difference; but if they are put on at different distances, it would make a difference. Generally, where the rail rests on the chair, it is worn away, and if it were shifted 9 or 10 inches away it might not come in the same place, and it would make the rail weaker.
5730. Did you find many instances where the chair has worked into the sleepers? Yes.
5731. Would that cause the road to become unsteady, and easily to get out of gauge? Yes.
5732. When you were relaying this portion of the road before did you find the road pretty well to gauge? No.
5733. Not to gauge? No.
5734. How would you account for it getting out of gauge;—would you account for it by the heavy rolling stock running over it? Well, it might or might not be owing to that.
5735. You do not care to express an opinion upon it? There is a different tempering in the rails. Some rails might be more easily worn than others, and the more the rails were worn, the narrower the gauge would be.
5736. That is the result of the process of flattening? Yes; on the top.
5737. But what I thought you meant was the sheering on the side of the rails? No.
5738. Do you find many of the rails on this part bulged much? Yes; that is what I am speaking about. That is what makes them tight.
5739. *Professor Warren.*] Flattened on the head, you mean? Yes.
5740. *Mr. Echon.*] What was your experience before you went with Mr. Proudfoot? About fifteen years.
5741. Or the permanent-way? No; not on the permanent-way.
5742. What on? On contractor's job. New construction.
5743. You have never been with contractors on the permanent-way? Not on the permanent-way; but I have been on with contractors on new construction work.
5744. How long an experience have you had with the permanent-way? Fifteen months.
5745. Did you work on this section fifteen months ago? Yes.
5746. And when did you relay the section. When did you do the lifting and relaying that you speak about. Is that twelve months ago;—how many? It might be.
5747. Just think of what you are saying, because we know? About five months ago.
5748. When did you commence? I cannot say to a certain day.
5749. But you finished it five months ago? I was on the job five months ago.
5750. I ask when you commenced relaying;—did you commence relaying as soon as you went on the job? No.
5751. How long afterwards? About a week afterwards.
5752. And you continued until the last five months, and it was then complete? No.
5753. That is what you said just now? No; I did not continue relaying.
5754. Never mind whether you were relaying or not. You finished relaying about five months ago? Yes.
5755. And the road was in very good order then? Yes.

5756. Do you know when the Baldwin engines commenced to run? No, I cannot say.
5757. Well, they commenced running when you got the road in good order. You were speaking about sleeper curves. Suppose a curve is under 15 chains how many additional sleepers do you put in to the length of the rail as compared with the straight? On the new road?
5758. On any road whether new or old? It all depends upon what the inspector tells me to put in.
5759. There is no choice at all. There is a standard for it? Well, what is the standard.
5760. That is what I am asking you. You do not know? Yes, I do know.
5761. Supposing it is a 15-chain curve, how many sleepers do you put in? Twelve sleepers.
5762. And if it is over 15 chains? Twelve sleepers.
5763. Then there is no difference in the number of sleepers whether it is under or over 12 chains? No.
5764. Then you have not followed instructions? There ought to be a difference.
5765. You say the engines are too heavy for the road. But at the same time you say that you have never travelled on one of them? I did not say that the engines were too heavy for the road.
5766. Well, I took down your evidence and I have it here? I cannot say anything at all about the engines. I never travelled on one.
5767. You cannot say whether they are injurious to the road or not? I cannot say.
5768. What is your opinion on the matter. Do they do more damage to the road than any other engines? My opinion is—
5769. We do not want your opinion, we want actual information as to what you have seen, because you are not here as an expert? Well, I am sure I cannot say. I cannot answer that question.
5770. Alright. You say you have 60 per cent. of broken chairs. Was it after you had taken the road up that you found you had only forty good chairs out of the 100? No; they were broken after the old road was taken out.
5771. *Mr. Brown.*] That is not what you said just now. You said that when you went to take the old road up you found 60 per cent. of chairs broken? Yes.
5772. That is not the question *Mr. Fehon* is putting to you now. He asks whether it was after you had taken the road up that you had 40 per cent. of good chairs. He wants to know whether you broke the chairs yourself in taking the old road up and had to get new ones to replace them with? We did not use any chairs in relaying the road.
5773. But no matter, pay attention to *Mr. Fehon's* question. Remember where you are. You say that when you pulled the road up you found only 40 per cent. of the chairs good and that the rest had been broken. Do you mean that that per centage was broken before you touched the road at all? Yes; there were only forty good chairs out of every 100.
5774. *Mr. Fehon.*] And how long ago was that? About four or five months ago.
5775. But you said you had finished it five months ago? About five months ago I said I was relaying.
5776. You said you were relaying from eighteen months ago to five months ago, and now I ask you when it was that these chairs were taken out? It was between four and five months ago.
5777. That is enough.
5778. *President.*] You say you worked on the length from 105 to 128? Yes.
5779. What work have you done on that length. Have you relaid it? Yes; parts of it.
5780. Do you know where the accident occurred lately? Yes.
5781. Have you relaid that length? No, but it was relifted twelve months ago.
5782. Did that part seem all right? Yes; to my idea it did.
5783. Nothing wrong with it as to the sleepers or anything else? No; I cannot say that there was.
5784. They were sufficiently close together were they? Yes.
5785. *Mr. Hoyle.*] What I want to know is this—were the broken chairs that you have referred to broken by your people in taking them out or did you find them broken when you got to the road. Were they broken by you in taking them out? No; they were not.
5786. They were broken before you touched the road? Yes.

George Frederick Evans, being sworn, said:—

5787. I am a fireman on the New South Wales Government Railways.
5788. *President.*] How long have you been on the railways? Nine years.
5789. What have you done during that time;—how long have you been a fireman? Seven years.
5790. And before that? Well, I have been driving, too.
5791. What part of the line do you do duty on? Well, I am stationed at Bathurst.
5792. From Bathurst to where? Penrith at the present time.
5793. *Mr. Hoyle.*] Were you firing on the express train on the night of the accident? Yes.
5794. You were firing the engine that drew the train that met with that accident? Yes.
5795. Can you tell me whether that train was stuck up before you got to the place where the accident happened? Yes. We took charge of the train at Katoomba, and going up Dargin's Bank—that is entering Clarence Siding station—she slipped, and stopped, though only for a second; she lifted again as soon as she got sand. It was a nasty greasy night, and the sand-pipe was choked. We had a very heavy load on too.
5796. What load had you on? Twenty-two and a half.
5797. Twenty-two and a half carriages? Yes; twenty-two and a half was the load.
5798. And you had no assistance? No.
5799. Were you stuck up more than once? Twice. Though it was only for a second each time. We lifted her again as soon as she got sand.
5800. *President.*] What do you mean by "lifted" her again;—do you mean that you went on again? Yes, sir.
5801. *Mr. Hoyle.*] Have you fired on any other engine besides this one? Yes.
5802. What is your experience as regards the engine? As a fireman?
5803. Yes? Well, I like the engines. They are good steamers, and pull well.
5804. Have you had any breaks with any of them since you have been here? No; not firing.
5805. Had you when you were driving? Yes; though it was not the engine's fault. It was the result of a collision. She broke a buffer-plate.

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Mr.
G. F. Evans.
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5806. And do you know of any failures, except this particular collision? No; it has not occurred with us.
5807. Then, in your opinion, these engines are good for steam, and good engines generally. They will haul the loads, and do everything that is required of them? They are master of their loads.
5808. Can you tell me whether on any other occasion—on a wet night—you have had any slipping to put up with;—though, as a matter of fact, you have not had many wet nights up there lately? It is always wet and greasy there.
5809. Well, did you have any other failures of the kind;—I mean have you been stuck up on wet nights on any but those two occasions to which you have referred? No, sir.
5810. Do you have to use sand frequently? No; at least I cannot say whether the engine-driver has his hand on the sand cock or not, but you would have to use sand with a light engine if you were starting in a fog on the mountains.
5811. At all events, you consider the load you are speaking of was a heavy load, and that it is owing to that that you were stuck up twice on the night of the accident? No. It was owing to the greasy night, I think. She walked the load off on other occasions.
5812. *President.*] You know where the accident happened near Tarana? Yes, I was there.
5813. Before that sad accident happened were you stuck near there, or did anything else happen? No.
5814. Everything was going alright? Yes, there was something about two years ago, but I was not on the train then.
5815. But I am talking about this particular night. The engine had not stopped just previously had it? No, she merely came to a dead stand when the accident happened, just as if the air pipe had burst. We did not hear any crash at all.
5816. There was nothing wrong with the engine? No.
5817. How far had you got on the curve when the accident happened? From what I heard, from what my mate said he thought it was about 98 yards.
5818. At all events you had taken the curve right enough, and were going round it? Yes, the engine was round the curve.
5819. *Professor Warren.*] Of course the uncoupling of the hose-pipe puts on the Westinghouse brake at once? Yes.
5820. So that pulled you up? Yes. That and the back portion of the train being against the rock cutting. I have been in a train when a hose-pipe has burst before, and the sudden stopping of the train threw us off our seats. We did not know anything of the accident until we went back. We thought it was a broken hose-pipe and went back to look for it.
5821. Of course the hose-pipe had been broken as a matter of fact.
5822. *President.*] Where was the broken rail? Well into the curve.
5823. And is that where you say you measured 98 yards?
5824. *Mr. Hoyle.*] It was not on the curve that the rail broke was it? No, not in the centre of the curve. It was just at the commencement of it. We were 98 yards in when we stopped.
5825. *President.*] What I want to know is, how far the broken rail was from the beginning of the curve? I think it is about the second rail in the curve. But at the time I was too much excited at seeing so many wounded people lying about to notice very particularly.
5826. *Mr. Fehon.*] If you had not had a Baldwin engine on your train, you would have had two ordinary engines? Yes, with that load.
5827. And would you have been able to pull up so quickly with two engines worked by two sets of men as you did with this Baldwin engine? No, the leading engine would not have had the brake on at all.
5828. And if you had run another 6 or 8 yards the chances are that the people in the sleeping car might have been killed? Yes, all killed.
5829. So that the safety of the passengers on that train depended as a matter of fact on the Baldwin engine? Yes.
5830. *Mr. Fehon.*] That is a fact.
5831. *Professor Warren.*] That is to say from the fact that the Westinghouse brake could not have been applied by both engines? Well, the pilot engine would not have touched the brake.
5832. Quite so. The pilot engine would have been running independently of the other engine as far as brake power is concerned. It would have had brake power but it would not have applied it, and as a consequence that if you had had two engines on the train you would have had the extra momentum caused by the pilot engine running on after the accident had happened.
5833. *President.*] Then, if that deduction is correct, the fact that a Baldwin engine was on the train when the rail was broken resulted in saving the lives of a great many persons.
5834. *Professor Warren.*] Yes; but then as a set-off against that it must be remembered that the Westinghouse brake could not be applied to both engines at once.
5835. *Mr. Hoyle.*] It is the Westinghouse that saved the train.
5836. *Professor Warren.*] That is perhaps a matter of opinion.
5837. *Mr. Fehon (to Witness).*] I will ask you a question or two, not in the way of eliciting evidence, but to show how matters are being managed with regard to these inquiries;—have you been in communication with Mr. Schey since this accident? No.
5838. Did you not write to him on the 2nd of May? No.
5839. Had you a letter from him? Yes; I received a letter on the 29th.
5840. *Mr. Hoyle.*] I must object to this, Mr. President. What has it to do with the Baldwin Engine Inquiry. I must object to such matter being imported into the proceedings.
5841. *Mr. Fehon.*] Well, I am only referring to a letter that has come into our hands in a perfectly legitimate manner. I may say at the outset, as was said at the beginning of the inquiry, that so far as the facts to be inquired into are concerned, we face them with the full knowledge that what we have done is right, and if we had to deal with the same case again we should repeat to-day what we did then, but we do object to the way in which our servants are undermined by persons who are not in the service now. Here is a letter addressed by Mr. Schey to a locomotive driver at Bathurst—"G. Evans, Esq.," and in this letter he says that Mr. Hoyle has gone to Bathurst to make inquiries—
5842. *Mr. Hoyle.*] I object to all this. It is entirely irrelevant to the matter that we have in hand.
5843. *President (to Mr. Fehon).*] I do not think you can read the letter, because it has nothing to do with

with this inquiry. No matter how wrong or how monstrous it may be we have still nothing to do with it. How can what Mr. Schey may have done affect Mr. Hoyle in regard to this Inquiry.

5844. *Mr. Fehon.*] They are coupled.

5845. *President.*] I do not think so.

5846. *Mr. Fehon.*] I mean in this letter.

5847. *Mr. Brown.*] They are not coupled, and I do not think it is fair to say so.

5848. *President.*] Without in any way expressing an opinion upon Mr. Schey's conduct, I will say that I draw a very marked distinction between Mr. Hoyle and Mr. Schey.

5849. *Mr. Fehon.*] So do I.

5850. *Mr. Hoyle.*] If there is anything that I pride myself upon as a man, it is doing things in a manly way, and I wish it to be understood that I have not written to a person in the department in connection with the Inquiry. I have not instructed Mr. Schey to make any inquiries on my behalf, nor has Mr. Schey given me any information. All that I have done I have done upon my own responsibility, and in many cases I do not know where I have got my information from. Some of it has come to me by means of anonymous letters, and all of it has been brought to me unsolicited. I based my charges in the first instance upon public documents furnished by the Commissioners themselves. Something in those documents alarmed me, and I decided to take my present course of action, and I have done it fairly and honestly, and I deny absolutely that I have had any communication with a railway employee. I would scorn to ask any man to give me information behind the backs of his officers, because if I was an officer in the department to-morrow, the man who gave information behind my back I should deal very severely with him.

5851. *Mr. Fehon.*] I have no wish to impute anything dishonorable to Mr. Hoyle. Although Mr. Hoyle has left the service of the Commissioners, when there we always esteemed him as an honorable straightforward man, but I say it is a rascally shame the way this service is being undermined by some who are bringing discredit upon honest men, and using our employees for the purpose. It is too bad also the way in which men are brought to the inquiries to give evidence on matters that they know nothing about.

5852. *President.*] I cannot deal with that, but if Mr. Schey were here, and it was proved that this letter was written by him, then I should make such remarks as I thought were necessary. I want Mr. Hoyle to understand, however, and I want you to understand that he and Mr. Schey are not in any way associated by the members of this Commission. I do not know that they are associated, except in so far as being Members of Parliament, and that does not necessarily make much association between them. Mr. Hoyle says that as far as he is concerned he has never consulted a single person in the department in regard to the matter that he has brought before this Commission, and I believe him. Indeed one can see that it is so from the fact that he often puts witnesses in the box who clearly do not help his case, and assuming as you may be allowed to assume that he is mistaken, you must admit that he is doing everything in a fair and manly way.

5853. *Mr. Fehon.*] We quite admit that.

5854. *Mr. Brown.*] We all re-echo those sentiments.

5855. *Professor Warren.*] Yes, I certainly think that Mr. Hoyle has been exceedingly fair in the way in which he has conducted the case.

5856. *Mr. Hoyle.*] I am exceedingly glad to hear these remarks from the members of the Commission. It is especially gratifying to me to know that I am not misunderstood by them, because I have suffered a good deal in that direction. The last witness that I have to call, until Tuesday, is George Yates.

5857. *Mr. Brown* (to Mr. Fehon).] Do I understand that you will put Mr. Rhodes in the box then?

George Yates, being sworn, said :—

5858. I am shed foreman at Dubbo.

5859. *President.*] How long have you been there? A little over eight months.

5860. And where were you before that? In the Eveleigh shop.

5861. *Mr. Hoyle.*] Are you the locomotive officer at Dubbo? Yes.

5862. I suppose there are some of the Baldwin engines there? We have four of the Baldwin engines there.

5863. Consolidation goods engines? No, we have no goods engines there; they are all passenger engines.

5864. Have you had any engines breaking down in your district? One.

5865. What was the cause of the break down? A valve-buckle broke.

5866. Was that on the occasion of a trial of this engine? Oh, that would make two failures. But that was hardly in my district.

5867. Well, as I do not intend to call any other witnesses, you might tell me about it, if Mr. Fehon does not object? Yes; an engine, No. 453, was sent to Bourke to bring down a load of fifty trucks of stock and it failed on the road. But Mr. Bough is in charge of the Nyngan district, and as the engine failed near Byrock it was not in my part of the road. You could not call that a break down however.

5868. *Professor Warren.*] What was the failure in the case of the engine that was doing the trial? The valve-buckle broke. It broke near Byrock, and since a valve-buckle has broken on the road.

5869. And is that the only accident you have had in your district? That is the only accident.

5870. Since they have been with you have you closely examined the wheels of the passenger engines? Yes.

5871. Do you find any defects in them? No, not real defects.

5872. Well, what you imagine to be defects? Well there are one or two that you might call welding flaws.

5873. *President.*] Do you mean in the spokes? Yes, in one or two of them. Nothing further.

5874. *Mr. Hoyle.*] There appeared to be cracks in the wheels? Well, I would not call them cracks.

5875. What is the number of the engines? 453, 446, and 447, though that is down here for repairs.

5876. It is down here doing a trial now, I believe? Yes, 449 and 455.

5877. Have you examined the wheels of the whole of them? I think 447 has most of the defects, if we can call them defects, in the spokes.

5878. Do you find these engines do their work well? Yes.

5879. And the only failure has been breaking a valve-buckle? Yes. When I say that 453 broke down in Byrock she was not stationed in our district, she was sent up to the particular work over which she broke down. We have had one failure whilst the engines have been with us.

5880.

Mr.
G. Yates.
12 May, 1892.

Mr.
G. Yates.
12 May, 1892.

5880. No failures with the brake-gear? No.
5881. No leaking in the tubes of the boilers? Well, we have had a tube weeping now and then, but that is all.
5882. Have you done more repairs to these engines than you would to new engines generally? Well, when I was called away to come down here I was compiling a return, and I believe the Scotch Yankees will be heavier in repairs than the Baldwins.
5883. I suppose you know nothing about the permanent-way? No.
5884. What I mean to say is that it has been no part of your duty to look after the permanent-way? No; but I may say that I believe the Baldwin engines may be lighter than some of the engines we have been running from Dubbo.
5885. Have you got the Scotch Yankee there now? No.
5886. Then your experience is that the Baldwin engines, with their greater weight on the driving wheel, would be lighter upon the permanent-way than some of the engines that you have? Yes; lighter than the Vulcans, for instance.

William Rhodes, being sworn, said:—

Mr.
W. Rhodes.
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5887. I am an engineer of the Baldwin Locomotive Works.
5888. *Mr. Fehon.*] How long have you been with the Baldwin Company, Mr. Rhodes? Twelve years.
5889. Had you any previous experience? I was ten and a half years on the Pennsylvania Railroad.
5890. What number of locomotives do the Baldwin Company turn out each year? Over 900.
5891. Do you know the total number of locomotives that the company has built? They have built over 12,000 up to the present time.
5892. I simply ask you this question to prove the importance of the works with which you are associated;—have you seen any of the recent Board returns? Yes, I have.
5893. What is given as a total number of engines in Great Britain? Sixteen thousand—a little over.
5894. Then your company have made three-quarters as many engines as there are being used on the railways of Great Britain? Yes.
5895. Is it usual for a company to send an officer to see that the engines are properly fitted up? Yes, sir.
5896. Is it customary for the firm to receive independent specifications of the engines to be built for the persons ordering the engines;—for instance, when a railway company is ordering an engine from the Baldwin Company, do they send a specification describing the minute parts of the engine, or simply do they give you the leading points? They simply give us the leading points; we furnish specifications for their perusal.
5897. Of course the breaking of axles has come under your observation since you have been here? Yes.
5898. What is your opinion with regard to iron axles? Iron axles are used very extensively. It is a matter of opinion amongst railway experts whether they prefer iron or steel axles. It is a very open question.
5899. What is the custom in America;—is it the custom to use iron or steel? Iron.
5900. What is your opinion with regard to axles;—do you make them yourself or do you order them from other firms? We generally purchase them from manufacturers of axles.
5901. Are you aware what class of material was specified for the axles for the engines? Iron or steel.
5902. We left it to the judgment of the Baldwin Company to use which they thought best? Yes.
5903. What was specified with regard to the testing of the axles on that occasion? Nothing that I know of.
5904. What is your custom with regard to testing? We depend upon the manufacturers for their axles when we purchase them.
5905. As a rule, you do not test these axles? No; not scrap axles.
5906. Would a test be any guarantee that if one axle is good the others are good also? Hardly; the drop test is not the result with regard to a scrap axle.
5907. What is the weight usually adopted in the United States? It has been from 67 lb. to 70 lb. per yard. I understand they are going into heavier rails.
5908. How long is it since they began to go into heavier rails? About two and a half years.
5909. And that would be on railroads where there is an immense traffic? Yes; a heavy traffic.
5910. Do you consider that the additional weight of the rail is for the purpose of getting a longer life out of the rail or for additional strength in order to carry the weight of the engines? Well, in both cases. Where they adopt a very heavy weight on the axle, on the rails between New York and Philadelphia, they have adopted a heavier rail also. But the lighter rails are almost universal throughout the United States.
5911. What is the weight of the locomotives;—I am speaking of the heaviest of the locomotives running on the principal roads of the United States at the present time. Take, for example, the Baltimore and Ohio road. It is a road that has been mentioned very often during this inquiry, and we are supposed to have adopted the Baltimore and Ohio style of engine. What is the weight of rail there? The main line from Baltimore West is a 67-lb. rail. The new line between Baltimore and New York is built of a heavier rail.
5912. And are these heavier rails running on the 67-lb. rail? Engines a little heavier than those you have imported.
5913. That would be a steel road, I presume? Yes; a steel road.
5914. And what is the weight on the driving-wheel on those engines? They run nearly 15 tons, on an average.
5915. That is, there are some a little heavier and some a little lighter, but the average is 15 tons? Fourteen and three-quarters tons, I think.
5916. What is the weight on our axles? Fourteen tons 8½ cwt., on an average, I think, as the weight was taken here. When they were weighed in Philadelphia they weighed rather lighter.
5917. What were our instructions to the company about weight on axles? That the weight on the axles was to average 14 tons 10 cwt.
5918. And have you complied with that? Yes, sir.
5919. That is, you have averaged that? Yes.
5920. But your driving-wheel is heavier? Yes.

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5921. Will you explain why it could be allowed to be heavier than the other wheels? We always make the driving-wheel heavier; it has no flange, and has nothing to do with the guiding of the engine. In fact, it is simply a weight rolling over the road in going into a curve, and has no effect on the rails at all.
5922. You are aware of the weight of the rails on the New South Wales line? Yes.
5923. The lightest rail here is heavier than the average rail used in America? Yes.
5924. *President.*] But, as a matter of fact, our rails are of iron and they are not.
5925. *Mr. Fehon.*] Our rails are of steel and iron.
5926. *President.*] The 75-lb. rails are of iron, are they not?
5927. *Mr. Fehon.*] Yes; and the 71-lb. rails are steel. There may be a few lengths of 71-lb. rails on the road, but they are very few. The rule is that the 75-lb. rails are iron and the 71-lb. rails are steel.
5928. (To Witness.) What plan has been followed in the construction of these locomotives? The regular system in the shops and the system of inspection that has always existed there.
5929. What is your system of inspection? As the parts pass from department to department they are inspected by the leading hand of each place, and also by the foreman; and then there is a general inspector, whose duty it is to pass from department to department and inspect everything, and also make the final inspection before the engine leaves the works.
5930. What defects have developed themselves in these engines, taking first the truck axles? The truck axles ran hot, and we used every endeavour to get them to run cool, with partial success, and finally some of them broke.
5931. You were fitting up other engines at the time these axles broke, so they were under your observation daily? Yes.
5932. *President.*] Did Mr. Rhodes come here to set these engines going?
5933. *Mr. Fehon.*] I am speaking of the bogie axles that have been replaced.
5934. *President.*] Yes, I know; but did Mr. Rhodes come out here to set the engines going?
5935. *Mr. Fehon.*] Yes.
5936. (To Witness.) There have been some remarks about the reversing-gear;—will you say what you consider are its defects? The screw of the reversing-gear is something that we do not use in America. The space was very confined in which it was placed, and after the engine had been running for a time the fulcrum-pin was broken. We replaced all the fulcrum-pins at the expense of the Baldwin Company.
5937. Your roads are more level than these, are they not, and so the reversing gear would not be so essential as on the steeper gradients on the new South Wales Railways? We never use screw reversing gear. We always use a lever.
5938. Who manufactured the break gear? The break gear was manufactured by the United States Brake Manufacturing Company. That company is considered by the Westinghouse Company as one of the best houses in the States, and we have never had any complaint about their work before. I may say that the Westinghouse brake is on the goods engines, and most of these failures have occurred with the engines that have been coupled to goods trains on which we know the breakage was very very severe, because the engine has to haul the whole train, without the assistance of a brake-van; but on the passengers they have a continuous brake throughout the train, and the strain is not so much on the engine.
5939. There has been a great deal said throughout this inquiry about the driving-wheels; it is said there are flaws in the wheels, or what are called flaws; can you tell the Commission the process of manufacture, whether it is a new or an old system of making wheels? This system of making wheels was introduced by the superintendent of the works some years ago, and we have made a great many of them. They are considered a strong wheel. There are little places where the film of iron near the hub presses over the spoke of the wheel, which would apparently look like a crack, but it is not a crack. It is just a film of iron that had been pressed round the wheel. The committee of the Franklin Institute sent to examine the process of making the wheels, and reported in favour of them. We have the same wheels running in the United States, in Mexico, and in the Argentine Republic, and so far we have had no failures with them.
5940. And did not all scientists who saw the process award a medal for it? Yes; they recommended that the inventor should receive a gold medal.
5941. *Professor Warren.*] A Franklin gold medal? Yes. I have the book here if you care to see it.
5942. *Mr. Fehon.*] What engines are the Baldwin Company at present making? They are making the very heavy engines now. They have $19\frac{1}{2}$ tons on the axle.
5943. And what would be the weight of the engine? It is given in one of these papers.
5944. You say that some of them are $19\frac{1}{2}$ tons; do you mean British tons or American tons? British tons—2,240 lb. to the ton. American short tons contain 2,000 lb.
5945. *Professor Warren.*] What number of the *Railroad Gazette* is it that you have? 12th February, 1892. The total weight of the engine is 123,000 lb.
5946. *Mr. Fehon.*] What weight of rail is that engine running on? It is running over the Brown Buck road, between Pennsylvania and New York. That has a heavier rail. It is a rail weighing about 76 lb. to the yard.
5947. A steel rail, about 76 lb. to the yard.
5948. Is not that the weight of the engine itself, without the tender? Yes; we never include the tender.
5949. Are you aware that your company raised any objection to the weight we were adopting on the wheels? They considered it was unnecessary to reduce the weight. They pointed out that they thought it unnecessary.
5950. *Professor Warren.*] That is stated in the correspondence as follows:—"The proposed reduction of weight per axle will, we fear, cause disappointment in the performance of the engines. We judge the same work is expected of them as that stated in the *Railroad Gazette*, as being performed by the Baltimore and Ohio engines. It should be fully understood that their deficiency will be correspondingly reduced. As we understand that the permanent way of New South Wales Railways is of a much more substantial character than the Baltimore and Ohio Railroad, we see no reason why the engines built for the latter could not be adopted entire. We should be gratified if on further consideration this is decided upon."
5951. *Mr. Fehon.*] Did not you build these Baltimore and Ohio engines yourself? Yes; I was in the shop when they were being built.
- 5951 $\frac{1}{2}$. You were superintending their construction, were you not? I was assistant-superintendent at the shop.

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5952. And you were out in this Colony some few years ago to superintend the erection of the other engines which have been bought from the Baldwin Company? Yes.
5953. And knowing the state of the railways in New South Wales, you consider that we would have been perfectly justified in adopting a heavier engine than the one we had? I consider that the Baltimore and Ohio engines would have been very suitable for the road.
5954. *President.*] You refer to the modifications about which the Company make some complaints in their letter? Yes. I think the New South Wales roads are better than the Baltimore and Ohio road—more secure.
5955. *Mr. Fehon.*] It has been stated that there were defects in the draw-gear of the engine. Can you explain that? The draw-gear was made rather light, owing to an error made in our office, and when it was pointed out to the Baldwin people they authorised us to replace them.
5956. The Railway Commissioners of New South Wales gave you instructions to make a heavier hook for the engines? Yes.
5957. With regard to the modifications made in the Colony, did they affect the stability of the engines? No, not at all. We changed the boiler from a waggon top to a straight boiler in order to reduce the weight.
5958. You have seen a great deal of the engines since they were erected. What is your opinion regarding them, as to their efficiency and stability for the work for which they were obtained? I consider them a very suitable engine, and a good working engine.
5959. Are these engines quite up to the average of the engine that you have supplied the other countries, and those that you use at home? Quite up to the average.
5960. In fact, I presume they are better in some respects, inasmuch as we have them fitted with copper fire-boxes and brass tubes? Yes; I consider that our people made more of an effort over these engines than they usually do.
5961. It has been stated that the wheels are considered light. What is your opinion, as a mechanical engineer as to the weight of these wheels, taking into consideration the general weight of the locomotives and the work they have to do? I think they are quite heavy enough.
5962. And it has been stated that the boss of the wheel is lighter than it should be? I cannot see that it is.
5963. Is that the ordinary size boss—the size which you usually put in engines of that character? For that class of wheel.
5964. But if you were making a cast wheel? I may make a bigger box then.
5965. The Company wished the engines to be heavier, but we wish to have them lighter, and how did they do it? By putting on a straight boiler instead of a waggon top boiler rising over the fire-box.
5966. And anything else. Was the engine shortened up in any other respect? No; those were the principal changes.
5967. Well, the wheels were made 2 inches lower, I think? Yes; the Baltimore and Ohio engines were 5 feet 4 inches.
5968. It was said that there was a danger of the axles working loose. Is there anything exceptional in the fixing of the axle on those engines from your usual practice? No; the axle is fixed on with pressure in the usual way. I do not think they would work loose.
5969. Of course, you know as a fact that one or two of the axles have worked loose. Is it a usual thing for engines from your works for the axles to work loose? No, we do not often get axles working loose, though occasionally an axle will work loose.
5970. I suppose you cannot account for it with regard to these engines? No, I cannot.
5971. It has been said that the rim of the wheel is defective. Are you aware of any defects in it? No.
5972. What is the general opinion of drivers in the United States as to these large engines. Do they favour them, or do they dislike them? Oh, they like a good sized engine. I never heard anything unfavourable with regard to them.
5973. Do you think they prefer them to the smaller engines? Well, a larger engine means more work for the driver; that is all there is about it.
5974. I do not think there is anything else I want to ask you.
5975. *Mr. Hoyle.*] Can you tell me how long ago it is since the first of this class of engines was made. I refer to the heavy engines—the Baltimore and Ohio engines? Somewhere about 1889 or 1890; I am not sure which.
5976. The first of them were made in 1889 or 1890? Yes.
5977. How long ago is it since you were in America? I left in June, 1890.
5978. Were you in America, in the Baltimore and Ohio shops, when these engines were being constructed? Do you mean the first Baltimore and Ohio engines?
5979. These engines for the colonial Government? No.
5980. Were you in the shops in America when these engines first began to run? Which engines?
5981. The Baltimore and Ohio engines? The engines running on the Baltimore and Ohio railways?
5982. These large Baldwin engines. Were you in America when they were first made for the Baltimore and Ohio Company? Yes; the New York, Lake Erie, and Western engines were the first heavy engines made.
5983. You say that the first heavy engine was made in 1889 or 1890? Yes.
5984. Do you know that the Baltimore and Ohio Company selected a new standard rail—a steel rail 85 lb. to the yard—in 1891? I had left the United States at that time.
5985. Is the *Engineering News* a good and reliable paper? Yes.
5986. I have it here. Let me quote from it. Here is a paragraph headed:—“Standard 85-lb. rail and joint, Baltimore and Ohio R.R., 1891. The Baltimore and Ohio Railroad has approved and adopted under date of May, 1891, a new form of standard rail section and joint, which are shown in the accompanying cuts, prepared from blue prints, furnished by Mr. H. T. Douglas (M. Am. Soc. C.E.), chief engineer. This track is to be laid on the division between Baltimore, Md., and Philadelphia, Pa., which is now laid with rails weighing 67-lb. per yard.” Well, that is a different division altogether, Mr. Hoyle.
5987. But does the Baltimore and Ohio engine run there? Not on that division.
5988. They run between Baltimore and Ohio? They run from Baltimore West. Philadelphia is west of Baltimore.
5989. Well, would that description apply to these rails? It does not refer to the road on which engines similar to these run, but it does refer to the engines running between New York and Washington.
5990. Is it not a fact that where these engines are running they are laying a heavier rail? Now, no doubt they are adopting a heavier rail all over America.

5991. *Professor Warren.*] That is the tendency of American practice, is it not? Yes.
5992. *Mr. Hoyle.*] Well, would that not be as much to meet the additional weight of the engines as for the purpose of economy? No, doubt it is more economical.
5993. *President.*] Do you understand the question;—would it be as much to meet the weight of the engine as for the purpose of economy—that is what Mr. Hoyle asks you, and you say, “No doubt it is more economical”—I want you to answer the question as he puts it? Well, I do not know what they had in their mind at the time the railroads began to adopt the heavier rail.
5994. *Mr. Hoyle.*] Is it not your experience that where you get a heavier rolling you get a heavier rail practically with regard to rolling stock of this description; or I might put it this way, do you think that the Baltimore and Ohio Company has been influenced by the great weight of these engines by putting down a heavier track? They are putting down a heavier track where they are running these engines.
5995. Well what is the difference in the weight of the driving-wheel of the engine running through the St. Clare tunnel and these engines? Well, I think they are about 20 tons on the driving-wheel.
5996. They have 19½ tons on their driving-wheel have they not? The St. Clare tunnel is a very short road.
5997. Is it not a fact that they have laid down a heavier rail there? It may be so; the line is only a mile and a half long.
5998. What is the difference between the weight of the engine as it is used in America, and the weight of the engine we have got out here? From the *Railway Gazette* of 8th June, 1891, page 421, I find that one of the drivers on the American engines is 1,002 lbs.
5999. With regard to these axles, does not your company provide for any tests from the persons from whom they get them? Not as a rule.
6000. Then you take the most reputable firms, and you take the axles that they make for you in the belief that they will be all right? Yes.
6001. Can you tell us whether the axles turned out very bad? Well, they run hot, and why they run hot it is difficult to say, but whilst they were hot they finally broke.
6002. Do you think that the axles you supplied here are the usual class of iron you supplied for axles in America? It may have been a little inferior iron, but it was impossible to test it.
6003. *President.*] You mean that the axles which broke were a little inferior iron? Yes.
6004. *Mr. Hoyle.*] We spoke about the loose wheels. When you are putting on the wheels, is there not some standard pressure that is used? Yes.
6005. If a wheel goes on at less than that pressure, ought it not be convincing that the wheel is too loose? Yes.
6006. And do you think that the wheel ought to be put on if it is too loose? No.
6007. And would that not imply neglect on the part of the man who was putting it on? Certainly.
6008. But when you are doing anything so important as putting on wheels is there not some officer whose duty it is to stand by and see that the work is done properly? There is a leading hand standing by.
6009. Do you consider, as in the case of engine No. 456, in which the wheel has worked loose from the axle that there has been some neglect on the part of your officers? It depends upon what pressure it took to press that wheel off.
6010. What is the pressure adopted for an 8-inch axle in America? About 70 or 80 tons.
6011. Then, as a matter of fact, you were not in America when these engines ordered by the Colonial Government were made? No.
6012. Therefore you cannot say whether the wheels put on to these engines were specially made for these engines, or whether they were in stock. Do you always make them specially, or do you keep them in stock? We never keep them in stock; they are always made specially for the different engines.
6013. If your company had been left to themselves, do you consider that they would have sent these engines here as they are? They would have come out rather heavier.
6014. But do you think that they would have sent these engines out if they had been left to themselves? They would have had a waggon top boiler, and probably a steel fire-box.
6015. You say that you were not in America in 1890? No.
6016. Therefore your experience as to what has been done to the roads, there is the result of reading? Yes.
6017. Do you consider it safe to run these heavy engines on a 75-lb. iron rail with the sleepers placed 3 feet apart? Yes; I think it is quite safe.
6018. Is there any road in America laid with 75-lb. iron rails—any road over which these heavy engines are running every day? I do not know.
6019. This screw reversing-gear was put on specially at the instructions of the Commissioners? Yes.
6020. And would not have been put on but for them? No.
6021. And the brake-gear—was the brake-gear used in America? Yes.
6022. Can you give us the difference in the weight between the Baltimore and Ohio engine, and the engines that we have? I only know the weight of these engines from what I have heard here, and I have given you the weight of the Baltimore and Ohio engines, as published in the *Railroad Gazette*.
6023. *Mr. Fehon.*] Speaking about the weight of engines, Mr. Rhodes, I will ask you have you seen the process of weighing in the Eveleigh yard? Yes.
6024. And do you consider that you can get the most perfect weight by that means, or by adopting a weighbridge? I think the weighbridge is the more correct of the two. I have known engines weighed on the steel yards to weigh one weight in one portion of the road, and another weight another portion of the road.
6025. Then you consider that we cannot place exact reliance upon the weights we have taken, and the results we have published? No; not until they have been tested on a weighbridge.
6026. I ask that question, because the Commissioners contemplate getting a weigh-bridge, in order to be able to obtain accurate weights. You were asked about the weight of rail in the St. Clare tunnel. Let me ask you this—are you aware of the weight of engines running on the Victorian railways? No.
6027. Have you seen them? I have seen them.
6028. They are all light engines, comparatively speaking.
6029. Are you aware that they have 100-lb. steel rails on the viaduct between the Spencer-street and Flinders-street railway stations for these light engines to run on? I have heard something of the sort.

- Mr. W. Rhodes.
12 May, 1892.
6030. There I suppose it would simply be in order to do away with the difficulty of much fettling on the viaduct; in other words, to get the longest life out of the rails, and it would have nothing at all to do with the weight of the engine? No.
6031. And that, I presume, would be the reason for the heavy rails in the St. Clare tunnel? Very likely.
6032. *President.*] You say it is a question of the weight of the engine, but that it is a question of the durability of the rails? Yes.
6033. *Mr. Fehon.*] What is the weight of the rails on the elevated railway in New York? The Manhattan has a very heavy rail, but I do not know what is the weight of the others.
6034. What is the weight of the engines upon those roads? They are very light, not much heavier than the motors.
6035. And what is the weight of the rail? I do not know exactly, but it is between 80 and 100 lb.
6036. At all events, is it a very heavy rail for a very light engine? Yes.
6037. Dr. Williams was out here for a long period some years ago. Are you aware whether he made himself familiar with the railways of Australia, their construction, and their requirements? Yes; he went into that matter very fully.
6038. And you think that Dr. Williams' opinion would be very valuable with regard to the suitability of a particular engine for a particular road? Very reliable, indeed.
6039. Are you aware that the railway Commissioners of New South Wales have adopted an 80-lb. steel rail as their standard rail? Yes; I have heard so.
6040. You have been erecting engines, I believe, the whole time you have been away from America? Yes.
6041. Where have you been since you left San Francisco? I left Vancouver for Japan, and erected engines in different parts of that country. Then I came to Australia to put up some motors in Victoria, and then I went over to New Zealand and Tasmania, and put up some engines there.
6042. At all events, that is your particular business—going about the different countries erecting engines for the Baldwin Company? Yes.
6043. *Professor Warren.*] I was going to suggest that we adjourn until Saturday afternoon. I find Mr. Brown cannot come to-morrow afternoon. Saturday, however, will suit me very well, and Mr. Rhodes is too important a witness to take up the tail end of a sitting in this way. I want to ask him several questions, and I do not see how I can possibly do so to-night. Will Saturday afternoon suit you, Mr. Fehon?
6044. *Mr. Fehon.*] Well, I am quite in your hands.
6045. *President.*] Would it not be possible to continue to-morrow?
6046. *Mr. Brown.*] Yes; that would be better, and I will try to be present.

Frank Dwyer re-called:—

- Mr. P. Dwyer.
12 May, 1892.
6047. *President.*] You have just handed a letter in, I believe you want to correct something that you said in your evidence. You stated in your evidence that you had only had fifteen months of permanent-way work. I believe you wish to correct that statement now by saying that what you meant was that you had only had fifteen months' experience of contracts for the Commissioners, but that you have had fifteen years' experience of permanent way work as a ganger? Yes; I meant to say that I had had fifteen years' experience of permanent way work instead of fifteen months.

FRIDAY, 13 MAY, 1892.

[The Commission met at 2 o'clock in the Board-room, Colonial Secretary's Office.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E., | ALEXANDER BROWN, Esq., J.P.

William Rhodes, recalled:—

- Mr. W. Rhodes.
13 May, 1892.
6048. *Professor Warren.*] I wish to ask you some questions, Mr. Rhodes, in the first place with regard to the matter of axles. The Baldwin Company, I understand, had the axles for the engines imported to this Colony made by some other firm; is that the usual course adopted? Yes; as a general rule.
6049. However, in this case they did do so? Yes; so far as I know.
6050. It is usual then, in America, for locomotive builders not to make their own axles? It is optional with the builders, but as a general rule they buy them from the manufacturer who makes the supply of axles a speciality.
6051. Is that why you do not specify any tests for these axles? Well, no; I do not think the question ever came up.
6052. Is it usual in America to specify tests for axles? No.
6053. Yesterday you said that you did not consider that the test of one axle was necessarily an indication of what the others might be? I referred more particularly to the drop test.
6054. Well, taking the drop test, the tension test, and ductility test, why should not they be an indication of what the others would be like if manufactured in the same manner? Well, you often get one good or bad axle among the lot.
6055. Would that remark apply equally to steel as well as iron axles? Perhaps not.
6056. Do you consider, then, that in the case of steel axles you would be more likely to get uniformity? Yes; I think there would, more probably, be uniformity.
6057. It is a moot point, then; you state in your specifications pretty thoroughly the tests to be applied for boiler plates. Well, with regard to the tests for boiler plates, would you say that what would apply with regard to them would apply pretty much to axles? Yes; but it is not the custom in America to test axles. In testing boiler plates they are sent with a test piece in each case which you cut off. There are a certain number for each boiler, and these pieces, when tested, are taken to indicate the condition of the remainder.

Mr.
W. Rhodes.
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6058. Then I understand that you trusted the axle manufacturers to supply good axles, and this, you believed, they did? We have admitted that the axles are not as sound as they ought to be.

6059. And you have replaced them with steel axles? Yes.

6060. Did it not occur to you that by supplying bad axles you subjected the travelling public to some amount of risk and danger? Yes; that would be so; but these things will occur even with steel axles.

6061. *Professor Warren.*] Of course, we know that it has been unintentional? I have known steel axles to break in the same way.

6062. Have you ever known four axles to break as quickly as these, so soon after the engines have commenced to be run? I have known three steel driving axles to break out of a number of engines that had been supplied.

6063. What number? Out of perhaps twenty-five new engines four, before they had been running for three months.

6064. Well, here we have four driving axles breaking in about the same time? Three I think were truck axles.

6065. Yes, they were bogie truck axles, and one was a tender axle? Yes, it twisted off the tender.

6066. The Commissioners, it appears, trusted to the Baldwin Company to supply good axles, and the Baldwin Company trusted to the manufacturers who supplied them with axles which had been satisfactory in the past, and the result was that they were delivered here in a defective condition, that is to say the locomotives were defective with regard to their axles?

6067. Scrap axles can only be inspected from the surface, and we made those inspections both at the works and here before the engines went into service.

6068. They looked clean? Yes, they looked clean and there was nothing to indicate that the axles would give trouble.

6069. But surely great carelessness must have been shown to cause such defects as were shown by these axles breaking? The great trouble was their running hot.

6070. But do you not think that the reason they broke was the bad material of which they were made? I believe the direct cause was the over heating.

6071. Well then what have you to say about the result of the drop test? The drop test with scrap iron is not thought to be very conclusive.

6072. Well what about the tension test? That is more conclusive certainly.

6073. You have seen the tension test? I believe I have, but I do not remember what it was, something about 20 tons, as far as I can remember.

6074. The tensile strength I mean, I will read them to you—

	Strain in tons, per square inch.	Contraction of area, p.c.	Elongation p.c.
A.....	22.07	12.9	11
B.....	19.36	2.5	4
C.....	21.04	31.6	13

So that you will see from this that the ductility is exceedingly low, and the tensile strength is also low. Looking down a list of subsequent tests I see that there is one where the strain is marked 16.6 per square inch, and the elongation 4 p.c. Surely you would not think that was iron fit to be put even into a bridge or the commonest girder work—you were disappointed in these axles I suppose?

6075. *Mr. Fehon.*] The proof is, that now they have steel axles they are not giving any trouble at all.

6076. *Professor Warren.*] That is not all Mr. Fehon, the question arises whether these engines were supplied in a defective condition, and were allowed to run on the railways until the axles broke, and not till then was it discovered that the axles were unsuitable;—the Baldwin firm, are I take it, responsible for that—do you admit, Mr. Rhodes, that the engines as delivered to the Commissioners were defective? Well, the axles were not of as good a quality as we should have liked, otherwise the engines have been all right.

6077. What about the reversing-gear? Yes; there was a fulcrum-pin broken on the reversing-gear, but that is not of very much importance.

6078. What do you say? I say that it does not amount to much.

6079. I do not think I need say anything more about the axles except this—do you consider steel axles better than iron? Yes; if you make the best quality of steel from makers of known repute.

6080. They are a very good axle, and you think probably better than iron? Yes; but if you get a poor quality of steel they are worse than iron.

6081. Should not an axle, whether made of iron or steel, be of the very best material that can be procured? Yes; and the people who make these axles try to procure the best material, but they do not always succeed.

6082. So you substituted steel for iron axles in the Baldwin engines after their arrival here, and supplied Otis steel, I believe? Yes.

6083. And Otis steel corresponds in America with Vickers' steel in England? Yes.

6084. So that now no danger may be anticipated with regard to the axles? No.

6085. An axle might break, in the same sense as a Vickers' steel axle might break, but that would be a rare occurrence? Everything has been done that we could do to make the engines reliable.

6086. With regard to the weight of rails, I am not clear upon what you said yesterday;—could you tell the Commission where the Baltimore and Ohio engines run to; I should like to be quite certain upon what sections of the line they travel? They run on the Piedmont section.

6087. Do they go from Philadelphia? No; on the Piedmont section, over the mountains. They are working on that section of the line on account of the heavy grades that are in it, in a similar way to the engines on the Blue Mountains.

6088. Are they not used anywhere else on the Baltimore and Ohio lines? They were built for that particular section.

6089. But would they be used for other sections of the lines on heavy grades? Yes.

6090. Do you know how far these engines—I mean the Baltimore and Ohio type—are used in America? They are used for that section; they were built for it and are used for it.

6091.

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W. Rhodes.
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6091. The ten-wheel New York, Lake Erie, and Western Railroad Company have similar engines, have they not? Yes; that is a heavy engine.

6092. It is nearly as heavy as the Baltimore and Ohio engine? Yes.

6093. What weight of rail would the New York, Lake Erie, and Western Railroad engine run upon—for it is practically the same as the Baltimore and Ohio engine—it has 100,000 lb. on the driving wheel? Yes, I know the engine perfectly well, but I can only give you the information from Phor's Manual. In Phor's Manual for 1891 it is stated:—"New York, Lake Erie, and Western Railroad steel 56 to 65 lb. rail." Here is also a paper from the American Society of Civil Engineers, 1888, in which they give the weight of the rails on many of the roads in America, and the weight per axle. New York, Lake Erie, and Western Railway 63, 67, and 74 lb. rails, eight-wheeled engine, 115,000 lb.; total weight, 78,000 lb. on the four drivers, that is equal to 17 tons on the axle.

6094. *Professor Warren.*] I suppose you would call that an express engine;—if you were describing it would you call it a ten-wheel engine? Yes.

6095. You would count both sides? Yes, in America we generally talk of that number.

6096. So that you would have 17 tons on the axle, and that would run over a 63 lb.-rail? Yes; we give the weight of the rails 63, 67, and 74 lb.—then there is the New York, New Haven and Hartford Railway, they have rails up to 74 lb.

6097. Now I will read you an extract from a paper included in the "Transactions of the American Society of Civil Engineers," dated December, 1891. It is on longitudinal *versus* cross-ties for railway tracks, and is by E. E. Russel-Tratman. In this paper it is stated that—

The single track of the St. Clair Tunnel at Port Huron, Mich., connecting the Grand Trunk Railway and the Chicago and Grand Trunk Railway, is laid with rails of the Sanberg pattern, weighing 100 lb. per yard; the Boston and Albany Railroad has adopted a 95 lb. rail. The Manhattan Railroad (New York) and the Chicago and South Side Rapid Transit Railroad (both elevated railways) are using 90 lb. rails. Now we are coming to something interesting,—The Baltimore and Ohio Railroad is laying 85-lb. rail upon its Philadelphia and Baltimore Division, the Great Northern Railway has laid 80 lb. rails on the heavy grades of the Pacific extension of the St. Paul, Minneapolis, and Manitoba Railway, and the New York, Lake Erie, and Western Railroad, and the Lehigh Valley Railroad have adopted 80 lb. rail sections. It may be noted also that the Government of South Australia has adopted an 80 lb. flange or the rail for use on the main lines of its railways.

6098. *Witness.*] You should understand that the Philadelphia and Baltimore Division is similar to the line running from here to Newcastle, and the main road is similar to the line running from here to Bathurst—so that you will see they are both distinct lines.

6099. *Professor Warren.*] They say that they are laying an 85-lb. rail—they do not say it is the only line.

6100. *Mr. Brown.*] I understood the witness to say that at a time he quotes from this manual there were engines of a similar character to these running over this line.

6101. *Professor Warren.*] But the practice is altering, and they are now taking the heavier lines.

6102. *Witness.*] The speeds have been increased immensely, and all the lines which put in the heavy rails have greatly increased their speed. On the Baltimore and Ohio line—between Baltimore and Philadelphia—they run an engine with 17 tons on the driving-axle at a rate of 60 miles an hour.

6103. *Professor Warren.*] And that is why they put in an 85-lb. rail, is it not? Yes; that would be a high consideration, taking into account the great speed of the train.

6104. We have the New York, Lake Erie, and Western Line and the New Haven and Hartford Line—they have adopted an 80-lb. rail and I understand from you that the engine on the former line is almost similar to the Baltimore and Ohio engine? Yes; that has been running since the year 1889.

6105. Well, they, at least, think that an 80-lb. rail is necessary, because they have adopted that as a standard section? They approve of a heavier rail, but, at the same time, they may have heavier engines for them; they have heavier engines.

6106. What is the heaviest engine that runs on the 80-lb. rail on the N.Y.L.E.W. line? Well, they had engines in 1888 with 17 tons on the axle.

6107. So that you consider that this rail was put down in order to accommodate heavier engines and not for the Baldwin engine? Also on account of the speed. That must not be lost sight of.

6108. And not for the engine that we are dealing with? No, sir; and it was also to meet the necessity of an increased rate of speed. The N.Y.L.E.W. Railway is a road which runs into Jersey City, and carries a very quick traffic, and speed is of great importance to it.

6109. Here is the paper referred to yesterday; I think it should be made clear that the Baltimore and Philadelphia section is not the one on which this engine travelled, and that that company have engines on their line with 17 tons on the driving-axle running at 60 miles an hour? Yes.

6110. Well, I have nothing more to say about that matter beyond this;—are you thoroughly satisfied, from your experience as an engineer, which has been considerable—ten and a half years on the Pennsylvania Railway and twelve years with the Baldwin Company, that with a 71-lb. steel rail or a 75-lb. iron rail, and with sleepers 2 ft. 8 in. apart, centre to centre, and 20 in. in the joints—that is, 10 in. on either side—which is the standard practice in New South Wales, the permanent way is safe for these engines? That has always been my opinion since I was here last time—1885 or 1886. I wrote a letter to the then Commissioner proposing the purchase of an engine with 15 or 16 tons on the driving-wheel.

6111. We have had evidence and calculations placed before us to determine what is a safe load on the driving-wheel for a given section of the rail;—now what is your opinion and your experience in these matters of the value of such investigations as applied to a rail? You must understand that I am not in the Permanent Way Department, and never have been.

6112. But you know about rails and their capacities? I know what we carry on rails.

6113. You know what a rail has to do, and you know exactly the conditions which have to be complied with? Well, we do not hesitate to carry 16 tons on the driving-wheel on a 65 or 70 lb. rail.

6114. You do not know I suppose whether it is usual in America to decide these matters by methods such as we have had explained to us? Well, I have never heard of it.

6115. The Americans calculate a great deal more than the English engineers do with regard to bridges, but I should like to know would they think it necessary to calculate a rail out in the way we have been told? Well, I have never heard of such a thing being done.

6116. *President.*] You mean as a fixed beam?

6117. *Professor Warren.*] Yes, as a continuous girder. (To Witness): You say you have never heard of it being done? No, I have not.

6118.

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W. Rhodes.
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6118. You have had some experience with regard to the weight of rails? Yes, on the Philadelphia and Reading line they have a 68 to 70 lb. rail. Their road runs past our doors, and we have built their engines, carrying 16 tons on the driving-axle.

6119. And knowing that fact you consider our permanent-way safe? Yes.

6120. What distance are the sleepers apart on the American line? Well, the best practice in America is to have them 2 feet apart from centre to centre.

6121. Our sleepers are rather more apart than that, they are sometimes as much as 3 feet apart? You have a better class of wood here for sleepers than we have.

6122. Yes; that is so, perhaps—but we do not get the support, that is to say, there is 50 per cent. more stress on the bearings on our lines. Well, I understand you are satisfied with our permanent-way as being strong enough? Yes.

6123. And it is for that reason you think your company was quite right in recommending the Baltimore and Ohio engine to the Railway Commissioners of this Colony, in preference to the modified engine they now have? Yes; I do.

6124. With regard to the defects in the wheels, you noticed them in the spokes, I suppose, do you say that they are not cracks? No, sir.

6125. But there are cracks that you could get a knife into? Yes, just on the edge; it is a small film of iron squeezed out in the die over the spoke.

6126. Do you consider that in these engines as supplied by your company to the Commissioners, there is a right proportion between the cylinder power and the adhesion? Yes.

6127. That the weight on the driving-wheels is proportionate to the cylinder power? Yes.

6128. You say that it has been proportioned correctly? Yes.

6129. The engines have not been over-cylindere? No; that has been pointed out in the letter of October, 1890.

6130. And you believe that these engines will do all that has been expected of them? Yes.

6131. In the *Railway Gazette* for 1890, pages 420 and 421, it says:—

Not long since the Baldwin Locomotive Works built for the Baltimore and Ohio railroad a 10-wheeled express locomotive having 21 x 26 in. cylinders under a guarantee to haul seven passenger cars up a 117-ft. grade, 17 miles long, at 25 miles an hour. This engine has been put in service and has more than met the guarantee, it hauls readily eight cars up the grade mentioned. At that speed and up that grade the engine is performing over 1,300 H.P. of work considering the total train load to be 400 tons. The weight on drivers is 102,000 lb. The total weight is 133,000 lb.

That is a Baltimore and Ohio engine, and this is what it is said to have done on this very long grade? Yes, there is also a written report contained in the letters from the Baldwin Co. which explains what they expect from these engines.

6132. These engines it is said in this report are guaranteed to haul a load of 440 tons at a rate of 25 miles an hour up a grade 17 miles long, with a grade of a 117-ft. to the mile—this is a tremendous performance? Well, I do not suppose you can expect as much from the engines with the rolling stock you have here.

6133. Why do you think our rolling stock will offer a greater resistance to haulage than the American stock? Yes, a great many of the trucks are four-wheeled trucks.

6134. Do you mean here? Yes.

6135. But that is better is it not? No; ours are all on double bogies.

6136. You mean you have a bogie at both ends? Yes.

6137. But so we have here have we not? On a great many, but on a great many others you have not.

6138. (To Mr. Echon.) Has the test train for Sunday bogie rolling stock?

6139. Mr. Echon.] It will have lavatory carriages, and they are all bogie rolling stock?

6140. Professor Warren (to Witness.) I am going to test this engine on Sunday with bogie rolling stock, why should there be a greater resistance here if we have all bogie rolling stock, it should be about the same? Well, there are side buffers which form resistance on the curve.

6141. Will that apply also on the straight? Not so much.

6142. But there is not much in that? On a short curve there is considerable in it.

6143. The test train is to be taken on a fairly straight gradient. Is not the load on the driving wheel of an engine the measure of its hauling power if the cylinder is adjusted to it? Yes.

6144. You say that the engines you have provided were properly adjusted in this way? We reduced the cylinder.

6145. Yes, and you reduce the weight of the driving-wheel, so that the New South Wales engines should haul proportionately as much as the B. and O. engines according to the weight on the driving-wheel? Yes.

6146. So that the B. and O. engines developed 1,100-horse power—these would develop 1,242—that is, 45 on a B. and O. driving-wheel multiplied by the smaller and divided by the larger, and you get 1,242 so that in our test on Sunday we should get that and indicate it in our cylinders? It is a large horse-power.

6147. Then do you think the horse-power is over or under-stated in what I have read in this number of the *Gazette*. It says the load hauled was 440 tons, up a 117-ft. grade, 17 miles long, driven at 25 miles an hour. I noticed that the actual resistance of the engine other than that due to grade is omitted; they have simply divided it out. Instead of 1,300-horse power it would be 1,936-horse power, so that if your engine was treated in the same way as brings the result in that case to 1,936-horse power, would you say we were treating it fairly. If you take Searle's formula you get the resistance on the straight at 25 miles an hour, it will be 16'35 lb. per ton;—is that what you would expect on the level—you know Searle's formula for train resistance? Yes.

6148. We are dealing with an American engine, and therefore I will use the American system adopted in such a case. This is the formula:—Average resistance of entire train in lb. per ton of 2,240 lb. for all

weights in gross tons— $R. = 5.4 + .006V^2 + \frac{.0006V^2 (\text{wt. eng. and tender})^2}{\text{gross wt. of train.}}$

6149. I suppose the writer in the *Gazette* is responsible for under estimating the power, he puts it at 1,300, whereas if you use the formula you get 1,936, he simply takes it on the grade resistance, so that it must be something more than that? In indicating an engine is more for scientific purposes.

6150. But it is the measurement of the horse-power developed in the cylinder? The tractive force of the engine is what we test it for practically.

6151.

Mr.
W. Rhodes.
13 May, 1892.

6151. If the engine develops the necessary horse-power or if it should fail to do so—and the load hauled indicated a certain horse-power we should take it in making our test? The test of an engine is the load hauled on a certain grade and at a certain speed.

6152. In a letter to the Railway Commissioners from Messrs. Towns & Co., dated the 15th December, '90, it states that the load is about 214 tons on the 17-mile grade, here is what it says.—“Have never had maximum load weight taken up 17-mile grade by 1,300 class engine.” This 1,300 refers to the horse-power. “It is about 240 net tons at schedule speed of 22 miles per hour, exclusive of weight of engine and tender. The 240 tons of 200 lb. are equal to 214 tons of 2,240 lb. There is much curvature on the 117-foot grade, and we are informed that in some places the actual grade considerably exceeds 117 feet per mile. The latter is the theoretical grade as shown by the profiles. The B. and O. locomotives have a total heating surface of 1,945 square feet, whilst the heating surface of the proposed locomotives, as per specification No. 5,231, is 1,937 square feet. From these data you can readily judge as to the power and speed of the new engines.” Now this clearly implies that the engines can do more than the 214 tons up the 117-ft. grade at 22 miles per hour, because it says that there are sometimes more than that, that the actual grade in some places considerably exceeds the 117, and that there are some sharp curves on it, so that merely taking that would be making the horse-power a little smaller than it is? I do not follow you exactly.

6153. What I say is this we have 214 tons hauled up a 117-ft. grade at 22 miles an hour and that grade is 17 miles long so that there is no doubt about the horse-power that would have to be developed? It would be a heavy pull.

6154. So that taking these facts into consideration we can scarcely go wrong in assuming that the B. and O. engine did this work? I suppose they did it.

6155. And we could express this work in horse-power? Yes.

6156. We have so many tons hauled up a long grade and we cannot be put off by rushing it—so that this is a really good basis for the calculation of horse-power? Yes.

6157. I do not see how there could be any mistake in that, that is what we propose to do, and it is just as well that you should understand this before going back to America so that you may be satisfied that we have tried to get our results as accurately as possible. You have already stated that the engines supplied to the Government are less powerful engines than the B. and O. engines by the weight of the driving-wheels, so that I must reduce this horse-power by the weight on the driver; taking the B. and O. engine as actually working on the grade and using the figures sent to the Railway Commissioners by the Baldwin Co. and applying Searle's formula for a speed of 22 miles an hour the horse-power I get is 1,192 and not 1,300, that is what I make out to be the horse-power of the Baldwin engines in accordance with the correspondence of the company, so that the weight on the B. and O. engines being 45.5 tons and on the New South Wales Baldwin engine 43.5 tons the work performed by the latter engine will be reduced on account of the decreased weight on the driving-wheel, and will therefore be 1,139 as against 1,192, there is, I believe, some question as to whether the engine is as heavy as it is represented to be by the Baldwin Company, the weight here taken on the steelyards varied from that on the weighbridge taken in America? Yes, we make the engines lighter than you do.

6158. *Mr. Fehon.*] We find steelyards very unreliable.

6159. *Witness.*] Yes, I have known steelyards to give a wrong weight.

6160. *Professor Warren.*] But what is the weight you make it in America. I want to make your engines do exactly what has been represented, and I understand it to be a weight of 43½ tons with regard to the New South Wales engines, and 45 tons with regard to B. and O. engines. Could you give me now the corresponding weight for our engines? There is a total weight on the coupled wheel, but I have not got it with me.

6161. *Mr. Fehon.*] We have cabled to America to get the weight from the Baldwin Company of the engine, they always take the weight before they send out the engines.

6162. *Professor Warren.*] I make it 97,900 lb. on the New South Wales engine, I have taken it as 2 tons less than the B. and O., and if it is less than that we shall reduce the horse-power correspondingly. I want now to refer you to the letters sent by the Railway Commissioners by your firm, showing that they must have considered the matter pretty much in the way I have done. The first letter was sent by the Secretary for Railways, Mr. McLaughlan. It is said that it is proposed to haul, with this engine, trains weighing 152 gross tons (340,500 lb.) up long grades of 130 feet per mile. That this would be the usual train, and it was expected to be hauled up this grade at about 22 miles per hour. Those were the usual gradients. Occasionally the train would have an occasional car, making the load, without engine and tender, 178 tons, or 394,240 lb. These loads include a full complement of passengers, mail, and baggage. The cars are all on trucks or bogies. “The regular load up the 176 feet grades would be 120 gross tons (269,000 lb.) without engine or tender. These grades are free from very sharp curves, and, therefore, in practice a greater proportionate load can be hauled than on the 130 feet grades. It is therefore expected that occasionally an extra car could be hauled, making the total weight of the train 144 gross tons (322,500 lb.) without engine or tender.” You would consider that the engines would do this work? I do not know whether they will or not.

6163. Well, we shall know on Sunday. These are the actual loads and gradients the engine will be tested with.

6164. *Mr. Fehon.*] Was not that modified afterwards?

6165. *Professor Warren.*] No; it is emphasised, if it does not do this work then the Baldwin Company is, I take it, responsible.

6166. *Mr. Fehon.*] Do they not say that they do not guarantee the speed?

6167. *Professor Warren.*] They say that they could do a great deal more. These are the words: “We have carefully considered the conditions of service for which these locomotives are intended, viz., to haul 150 to 176 gross tons of cars and load at a speed of 22 miles per hour up long grades of 130 feet per mile, combined with severe curvature, and to haul up grades of 176 feet per mile, with easier curvature, loads of 120 to 144 gross tons. We note that the sharpest curves are of 528 feet radius, but it is not stated that this is the radius of the curves in combination with the 130-foot grade. Our calculations indicate that the engines will have sufficient tractive force to haul these loads, but we prefer not to make a definite guarantee of the speed, as it is more or less dependent upon conditions of which we are not fully informed, such as the quality of the coal, the wheel have of the rolling-stock, condition of track, &c.”

Following

Following on that it says:—"In order to compare the stipulated performance with what the B. and O. engines are actually performing in daily service, we telegraphed to the General Superintendent of Motive Power of that Company, inquiring as to the latter. The telegram in reply then goes on to say that the B. and O. engine had hauled a load of 214 tons on a 117-foot grade, at a speed of 22 miles an hour; so that they clearly implied that these engines could also do that; they infer that there is a good prospect of the engines doing this work, so I presume, Mr. Rhodes, that if good coal is supplied you would expect them to do that? Well, they would come close to it, but I should not consider that a guarantee.

6168. Not in the sense in which you would use the term, but you would regard it as a moral obligation.

6169. It is a fair anticipation. You would anticipate that they would do that. I will now read what the Commissioners say. They wrote the following letter, which, I think, is the most important letter in the correspondence, showing that they clearly understood the matter.

With reference to the twelve express passenger engines, ordered in September last, kindly note these should be numbered from 446 to 457 in plain block letters, 7 inches high, in gold, on the sides of the cab, on the front buffer beam, and the back of the tender tank.

I think it well to inform you that our 12° curves on which these engines will work are on 160-foot grades, and that the worst curves on the 130-foot grades are about 7°. All our passenger rolling stock is carried on trucks, chiefly four-wheel, with about 5" 6" wheel base. All the axle-boxes are made for oil; all the wheels under the rolling stock are 36" diameter, on tread and steel tyres.

We calculate that to take a train up the 130-foot grades at 22 miles an hour will require about 50 indicated horsepower less than is wanted by the Baltimore and Ohio engine.

That is, I presume, because the weight on the cylinders is less? I have calculated it, and I make just that difference.

During its maximum work, and, as in our weight for the train (176 tons gross, exclusive of engine and tender) we include an ample allowance for the weight of passenger and baggage, we anticipate that the engine will be fully equal to this performance.

From this it will be seen that the Commissioners anticipate that the engine will draw 176 tons at a speed of 22 miles an hour up a grade of 130 feet per mile. I wish you to see that they were justified in doing so from what was said in your letter of the previous date, (15 December, 1890)? Yes, I see what you mean.

6170. Do you not think that the engines clearly ought to do that work? There are several other letters which all show that the Commissioners follow you, except that one; that is the only one in which a slight doubt is thrown on the speed. You have a long account of the performance of your engines on this grade, and you are morally responsible, I think, for the consequences, if it is not found practicable with them? It is a desirable thing to accomplish that, I think both parties consider that to be so.

6171. Now, I will ask you if in using Searle's Formula, I should make the resistance either too big or too small, and suppose I should calculate the performance of the B. and O. engine from the same formula and in the same way, the mistake I may make, which would apply in both cases, would not influence the ratio of the results? Yes, I think that would be so.

6172. If for example, I should say 20 tons instead of 15, I should have all high throughout? Yes.

6173. We shall make out these calculations using Searle's Formula, and take out the areas on the indicator diagram, and record the whole thing in the report, and thus see whether the engines actually do the work they were expected to do, and now that we have told you exactly what we intend to do, I should like to know if there is anything you would like to have done in addition to what I have indicated or whether there is anything you would like to criticise, as I am anxious your firm should be satisfied with the way we propose to carry out these tests? All these tests depend on the quality of the coal—how the engine is steaming and on the practical working of the engine, if any of these things go wrong, the consequence will be a disappointing result.

6174. (To Mr. Fehon.) I suppose you have got the best coal you can.

6175. *Mr. Fehon.* They are going to take a little Newcastle coal.

6176. *Professor Warren.* I do not care what kind you get, but I wish it to be good. Whatever results we get in this trial you will not get as good under ordinary circumstances, of course.

6177. *Witness.* They stipulate in the correspondence that it should be good coal.

6178. *Professor Warren.* If we use the best coal we shall be testing them fairly.

6179. *Mr. Fehon.* We shall get Newcastle coal.

6180. *Professor Warren.* If we take the best coal we can Newcastle coal, do you consider that will be fair? Yes, if the steam-pressure is kept up.

6181. We shall record the pressure every few minutes? Anything may affect your boiler-pressure. If the steam-pressure were not kept up I should think it unsatisfactory.

6182. I suppose you will accompany us on the trip yourself? I am afraid I cannot.

6183. I wish you could; I desire to treat the matter as fairly as possible, and it is a matter of accuracy no matter how things go? I do not think that I could be of any assistance at all.

6184. I should like to see you there just to be sure that you are satisfied. I have nothing more to say, Mr. Rhodes, thank you.

6185. *Mr. Brown.* I have only one question to ask you, certain alteration, and amendments were made in the specifications supplied by the Baldwin Company—These amendments were made by a committee of gentlemen who were connected with the Government Railways; now I want to know did these alterations and amendments interfere with the efficiency and speed of the engines you proposed to supply, according to the pattern of the engines used by the B. & O. Company? It reduced the power of the engine somewhat.

6186. As a matter of fact, these amendments did then interfere with the speed and power and tractive force; from your standpoint, I understand you would have recommended the Government to take a B. and O. engine rather than these. Were the Railway Commissioners or their officers doing right in making these alterations to suit the B. and O. engines to our lines? Quite right, if they were satisfied with obtaining a little less work from them.

6187. Supposing that they did a little less work, are you quite sure that these changes did not interfere with the character and efficiency of the engines, may they not on the other hand have made them, so far as you are concerned, more suitable for the railways here? Yes.

6188. Then inasmuch, as they did not decide on taking a B. and O. engine, your people refused to guarantee them,—was that the reason? Yes; very much.

6189.

Mr.
W. Rhodes.
13 May, 1892.

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W. Rhodes.
13 May, 1892.

6189. That is the Baldwin Company did not know what would be the effect of the changes in the specifications they supplied, and therefore would not guarantee the speed of the engines? Yes.

6190. You do not think that these alterations made any material difference, but in fact made them more suitable and lighter for the work? Yes.

6191. And you consider that these engines are suitable in every respect for the work of our railways? I think they are entirely suitable in every respect for the railways of New South Wales.

6192. *Mr. Hoyle.*] Is it not a fact that on nearly all the railways in America they are increasing the weight of their rails? On the Eastern roads they are increasing them considerably.

6193. I see in the *Engineering News*, of 1st October, 1891, it is said, "That in all new works not less than sixteen ties must be placed in each 30 feet, 67-lb. rails placed evenly"—now what would that be? I suppose it would be about 1 ft. 11 in. apart. Referring to this matter again on February 20th, 1892, the same paper says, "An interesting and highly important fact is readily discernable in other tables yet to come. In the Northern United States, New York, Great Britain, and Germany, derailments are becoming of trivial importance as compared with collisions. In the south, with its few trains and most poor track, it is the other way. The west is betwixt and between. The moral deserves to be written in letters of gold over every operating officer's desk 'when track is once brought up to the east of Chicago, British, and German standards, derailments of serious moment tend to become evanescent.'" So that you see there is a statement that where in America they have not brought their rails to the English, German, and Chicago standard these derailments have been frequent; and this shows that the rails are too light for the work they have been doing. There is another reference in another copy of the *Engineering News*, of February 22nd, 1892, it says, "From Jersey City to Bound Brook the central railroad of New Jersey has four tracks, ballasted with broken stone, the two middle tracks have heavy rails spliced by angle-bars 30 inches long with six bolts," and again, "The new standard tracks and the standard track sighs of the Baltimore and Ohio railroad have been described and illustrated in *Engineering News*, July 18th, October 31st, and November 7th, 1891. The cuts and fills are of a loose gravelly character, and are in places badly washed and worn by the rain, necessitating frequent work in repairs"—now this is the very thing that I mentioned yesterday; it shows that the newer and heavier road is being adopted throughout America, and we find that the American railways are increasing their rails to the highest standard. Can you give us any reason, Mr. Rhodes, for this being so, excepting for the great power they are running on the line at the present time;—is there any reason beyond the one that the original rolling stock is too heavy? That is the Philadelphian section of the Baltimore and Ohio line. As I have stated before, they run their trains at the rate of 60 miles an hour with a weight of over 17 tons on the driving-axle, or, in other words, 6 tons 16 cwt. on the driving-wheel.

6194. On the Jersey City and Bound Brook line the paper says;—is that the same place? That is another section, between Philadelphia and New York. They run 19½ tons on their driving-axes there.

6195. Taking into consideration the fact that they use 67-lb. rails, and also that the sleepers are only 1 ft. 11½ in. apart, do you think that our lines, with the sleepers 3 ft. apart and 75-lb. iron rails, are safe? You must also look at the engines. The engine that runs over the lines in question are 19 tons 14 cwt. on the driving-wheel, and they travel at the rate of 60 miles an hour on a 76-lb. rail.

6196. Steel rail? Yes.

6197. What do you say is the weight on the driver? 19 tons 14 dwt.

6198. *Mr. Brown.*] Between the 71-lb. steel rail and the 75-lb. iron rail there is not much practical difference; for practical purposes they are much the same.

6199. *Mr. Fehon.*] Both being sound you consider they are equally strong.

6200. *Mr. Brown.*] You say that steel is as cheap as iron.

6201. *Mr. Fehon.*] You can get steel rails as cheap as you can get iron rails.

6202. *Mr. Brown.*] They will last much longer.

6203. *President.*] And there is no difference except in durability?

6204. *Mr. Fehon.*] We should give a preference of steel over iron.

6205. *President.*] Because it is stronger?

6206. *Mr. Fehon.*] Yes; but considering that iron rails are perfectly sound, we believe that it is the equivalent of a lighter steel rail.

6207. *Professor Warren.*] Iron rails may be destroyed in detail, but steel is more homogenous.

6208. *Mr. Fehon.*] Steel is subject to the same process of destruction, but perhaps to a less extent than iron.

6209. *Professor Warren.*] Yes; but experiments show that it has a greater vibrating strength—that is, a greater strength against repetitions of load. In other words, fatigue.

6210. *Mr. Fehon.*] I have seen some specimens of steel rails in Bessemer steel which have gone very similar to iron after being a little worn.

6211. (To Witness.)] Do you consider that the Railway Commissioners of New South Wales in having adopted an 80-lb. steel rail as their standard rail are at all behind the rest of the world? No.

6212. *Mr. Hoyle.*] Certainly not. They have done quite right.

6213. *Mr. Fehon* (to Witness.)] Speaking of American ties, can you tell us the size of the American tie as compared with the sleepers used in this country? The cross ties that are used in America are from the woods found in the immediate neighbourhood. In the West they use redwood, and in the East they use oak.

6214. And that is a comparatively soft wood compared to the wood we use in this country? Yes.

6215. And the size of the ties are rather smaller than ours, are they not? They are about the same.

6216. Well, I remember in my days they were smaller.

6217. *President.*] If they are only 2 feet apart, and our sleepers are 3 feet apart, surely, considering that the rail has to be borne by them, those 2 feet apart must be better than those 3 feet apart, no matter what kind of wood the sleepers are made of? Yes; but a good deal depends on the sleepers. Supposing that the wood should rot by reason of its inferiority in the 2-foot sleepers, that will give a bearing area of 4 feet.

6218. I quite agree with you there. Of course it must be so; but if the wood remains good, sleepers 2 feet apart must be better than sleepers 3 feet apart.

6219. *Mr. Fehon.*] Yes; some lines are laid with longitudinal sleepers. The Great Western, in England for example, is laid with longitudinal sleepers, and there, of course, they have a bearing the whole length of the road, and in consequence can use a much lighter rail.

6220. *Mr. Brown.*] The practice in America is to tie them much closer than here. I remember that in the case of the Hawkesbury bridge, where they sent in their own specifications, they put the sleepers 14 inches apart.

6221. *President.*] But I understand there is another reason for that. As I understand it, in case of a tunnel, or a bridge, or a viaduct, or in any place where you cannot relay them without inconvenience, it is customary to make the work very much stronger than in other places in the first instance.

6222. *Mr. Fehon.*] Yes; you usually put a heavier head on the rails; and consequently, instead of a line lasting for three years it will probably last for nine.

6223. *President* (to Witness).] Have you been on the Western Line? Yes, sir.

6224. Do you know the Solitary Creek Bridge? No.

6225. Do you know a creek that you cross in going to Tarana—just a little time before you get there? I have crossed it.

6226. Have you noticed the permanent way over it? Yes.

6227. Do you think that the engines are too heavy for the permanent way, there? They rode very steadily over that, and I was on the engine at the time.

6228. *Mr. Fehon.*] I understand from Mr. Hoyle that he has only one more witness, and that that witness will speak on the question of the strength of the road, and that his evidence will not affect what has been given by Mr. Rhodes. I have asked him that question in order to make everything clear for Mr. Rhodes to get away on Monday. As I stated before, he is leaving for San Francisco on that day, and it will be extremely unfortunate if evidence is called subsequently by Mr. Hoyle in refutation of anything he has said.

6229. *President.*] Very well, then you will start your evidence on Tuesday, Mr. Hoyle. Is it the wish of both of you that we should adjourn from to-day over till Tuesday?

6230. *Mr. Hoyle.*] Yes; for my part I desire it, Mr. President.

6231. *President.*] You are sure you do not want Mr. Rhodes again, Mr. Hoyle?

6232. *Mr. Hoyle.*] Quite sure.

6233. *Mr. Brown.*] You have one more witness, and he is summoned for Tuesday next?

6234. *Mr. Hoyle.*] Yes; that is so.

6234½. *Mr. Brown.*] And after that the Railway Commissioners will go on with their case? Yes.

TUESDAY, 17 MAY, 1892.

[The Commission met in the Board-room, Colonial Secretary's Office, at 2-30 p.m.]

Present:—

ALEXANDER BROWN, Esq., M.L.C., J.P. (Presiding).

PROFESSOR WARREN, M.I.C.E.

6235. *Mr. Hoyle.*] Previous to calling the evidence of my final witness, I wish to state that at the last sitting of the Commission I asked to be supplied with a report of certain tests that had been made in connection with the Glen Lee Bridge. That report was promised, but up to the present time it has not been produced; and as I wish to ask several questions relative to it, I feel that I am placed at a disadvantage by not having it before me at present. Mr. Pollitzer states to me that he wishes to correct some evidence which he gave at the previous meeting of the Commission.

6236. *Mr. Brown.*] I understand that you want something to be produced which you say the department promised to produce, but has not.

6237. *Mr. Hoyle.*] Yes, it is a report of certain tests which were made by Mr. Foxlee, Mr. Hickson, and Mr. Deane on the Glen Lee Bridge. Mr. Fehon promised to let me have it, but up to the present time it has not been produced.

6238. *Mr. Brown.*] What have you to say, Mr. Fehon, about it?

6239. *Mr. Fehon.*] It is a question how far the production of anything in connection with the Glen Lee Bridge affects the matters before the Commission.

6240. *Mr. Brown.*] I think we have got past that stage. I understand that you promised to produce it.

6241. *Mr. Fehon.*] I may have done so inadvertently. I do not see how this inquiry will be affected by the report. I may state that an article appeared in a certain Sunday paper reflecting upon the stability of the Glen Lee Bridge, and one of the gentlemen now in the room came before a Committee of the Department, and there made certain statements.

6242. *Mr. Brown.*] Would it not be better, Mr. Fehon, to give this as evidence. It goes down in the short-hand notes, but has not the same weight as evidence given upon oath. You understand the difference there is between a mere statement made in this way and a statement made upon oath, so far as this Commission is concerned?

6243. *Mr. Fehon.*] We see no necessity for giving information which is not pertinent to this inquiry merely for the benefit of private persons sitting at this table.

6244. *Mr. Brown.*] Then, I understand that the objection of the Commission is that this information would be given to parties other than those who are parties to this inquiry.

6245. *Mr. Hoyle.*] I believe a report of these tests will show that this bridge is not capable of carrying a Baldwin engine, and, therefore, this report will, I think, disclose something material to the inquiry before the Commission.

6246. *Mr. Brown.*] Part of your allegation is that these engines are unsuitable for our permanent way, and you think that the report upon these tests will support that allegation?

6247. *Mr. Hoyle.*] Yes.

6248. *Mr. Fehon.*] Mr. Foxlee will be put in the witness-box and he will give all the evidence that may be required about that particular bridge to the Commissioners.

6249. *Mr. Brown.*] Or Mr. Hoyle.

6250. *Mr. Fehon.*] Yes, or Mr. Hoyle, he will be present.

6251. *Mr. Brown.*] Will that satisfy you, Mr. Hoyle. If Mr. Foxlee made a report you can call for its production when he gives his evidence.

6252. *Mr. Hoyle.*] I think it would have been better if it had been produced before. To take me on the hop like this is unfair. It gives me no time to look over the report, and I cannot ask the questions I would probably

probably otherwise have put to my witness if I had that report in my possession. The reason why I asked for its production was that I might have it in my possession to-day. Even if it were produced now it would be useless to me as I would not have an opportunity of looking at its contents and framing my questions from them.

6253. *Mr. Brown.*] Well, will you be content with the situation as it has now developed.

6254. *Mr. Hoyle.*] I suppose I must be.

6255. *Mr. Brown.*] It is for you to say in forwarding the interests of this Commission whether it is desirable to have it produced now, or whether it would not be prudent for you to wait until Mr. Foxlee is put in the box.

6256. *Mr. Hoyle.*] I think it would be useless to produce it now, as I should have no time in which to digest its contents.

6257. *Mr. Brown.*] We shall give you an opportunity during Mr. Foxlee's examination of dealing with the matter.

6258. *Mr. Hoyle.*] Very well. Mr. Pollitzer wishes to make certain corrections in the evidence he has given.

6259. *Mr. Brown.*] We have no objection whatever to that, so long as no new evidence is introduced.

Samuel Joseph Pollitzer, recalled, said :—

- Mr. S. J. Pollitzer. 6260. I am desirous of making a correction in regard to some remarks made by Mr. Fehon.
- 17 May, 1892. 6261. *Mr. Brown.*] You cannot correct any remarks made by Mr. Fehon. You can only correct your own evidence.
6262. *Witness.*] It is with regard to a question put to me by Mr. Fehon. He asked me to tell him what weight would be required to fracture the rail broken at Tarana under the drop test. I answered his question, but I had no right to do so. It was an absurd question, and should not have been answered, and therefore the answer I have given I do not wish to be considered as given in my evidence. That is the main point I wish to give as a correction. I have shown great industry in compiling my opinions, and I now desire to submit the last number of *The Engineer*, from which I would like to quote a certain passage.
6263. *Mr. Brown.*] What is that for. Fresh evidence?
6264. *Witness.*] It is simply in explanation and support of my character as an engineer, which has been questioned by Mr. Fehon.
6265. *Mr. Brown.*] I really do not think that is a matter at all in question.
6266. *Witness.*] I wish to read it on account of what Mr. Fehon said.
6267. *Mr. Brown.*] Well, there is no objection to your doing so for the information of the Commission, but it must not be considered as part of its proceedings. (*To the shorthand writer*): Do not take this as part of the proceedings. (*The witness then read an extract from a scientific journal.*)
6268. *Mr. Brown.*] I do not think what you have been reading concerns the Commission, excepting in estimating your value as an engineer.
6269. *Witness.*] I simply came here with that object to vindicate my position as an engineer, on account of what had been said by Mr. Fehon.

Albert Leahy, being sworn, said :—

- Mr. A. Leahy. 6270. I am a civil engineer, and have been resident in the Colony between seven and eight years. I am not connected with the Railway Department, but hold a position in the Roads and Bridges Department.
- 17 May, 1892. My position there is that of draughtsman. I am supposed to be what is called "an extra temporary hand." The chief of my department is Mr. McDonald.
6271. *Mr. Hoyle.*] Are you a member of the Institute of Civil Engineers? I am not a member. Perhaps I may explain why I am not. At the time of my apprenticeship, or on its completion, some gentlemen who were connected with the institute proposed that I should become a member. I gathered from gentlemen who were seeking employment as engineers that they believed that membership in the institute was in the nature of a diploma, upon which they could trade. I thought at the time that it was not worth while becoming a member, and for the last twenty years I have continued to think so. I found that it was a very good introduction for quacks. Of course I do not mean that is so in every case. There are engineers and engineers.
6272. Have you had any experience in connection with railway matters? I served my time with Mr. Charles de Bergue, who was at that time one of the leading authorities in connection with permanent ways. He has carried out work in all parts of the world, paying special attention to permanent ways. He had patents which nearly all the Government representatives in various parts of the world have made close inquiry into, and I believe that at that time his system of permanent way was considered to be one of the best that could be laid down. My association with him afforded me such facilities in the way of introductions, that I was enabled to obtain entrance to and go round nearly all the works in England and some of those on the Continent, for the purpose of studying questions in connection with permanent way.
6273. And did you make such a study? I did. So much so, that at the time when the Russian and Indian Governments were considering whether a 4 feet 8½ inch gauge, or one smaller would be the better, I remember that Colonel Scratchley, Captain Tyler, Mr. Bender, and many other gentlemen, including the Prince of Wales and the Duke of Sutherland, who interested themselves in this question, when I was afforded an opportunity of seeing with them a number of experiments then being carried on about London. My experience also extended to association with Mr. George England, who I believe was one of the fathers of railway works in the old country.

6274. *Mr. Hoyle.*] What practical experience you had of railways was, I understand, during the period you were serving your time? Yes. Mr. A. Leahy.

6275. What position did you hold then? I was studying as a civil engineer, up to 23 years of age.

6276. *Mr. Brown.*] What bearing have the Prince of Wales and Sir John Fowler on your experience? Well, sir, it was in this way. It was in connection with "The Little Wonder," when Mr. Fairlie was bringing forward his narrow gauge engines in England, and these gentlemen from Russia and India were looking into this matter, and I was assisting Mr. John England in hunting up information.

6277. You were his assistant? Yes; we were carrying out experiments at New Cross.

6278. *Mr. Hoyle.*] Have you had much experience in connection with bridges? Yes; both on railway and road bridges.

6279. In connection with their construction? Yes; and in superintending their erection.

6280. Have you had also experience in the manufacture of rails, and do you know the strains to which they are subject? Yes.

6281. Both iron and steel rails? Not so much in steel rails but in iron. Steel has only come to the front in recent years, but in the manufacture of iron rails I have had a lot of experience, and I have been engaged for more than three years investigating into questions affecting iron and steel making for the purpose of rails. I was at Bolckow Vaughan's, and the Walker Ironworks, and Rosedale and Ferry Hill, at Durham, among the largest works of this kind, turning out about 600 tons of iron. I was engaged in making tests of iron and steel and also coal and fluxes and other things necessary for that particular kind of work.

6282. *Mr. Brown.*] I understand that you have had an opportunity of visiting all these places? Yes; before I came out here I had an opportunity of going through the whole of the works in Belgium, and also, if I had wanted to do so, through those of France and Germany. They would have shown me what I desired.

6283. *Mr. Hoyle.*] Your father was well known in connection with ironworks in England, was he not? Well, he has been dead some fifteen or sixteen years now.

6284. Will you kindly explain to the Commission the circumstances connected with your discovery of the weak points in the Glenlee bridge? On one occasion I was going down to Picton with a view to looking for land for selection, and in passing the structure, which was near completion, it occurred to me that it looked rather weak, and I thought that on my return journey I would pay it a visit and inspect it carefully. I was not, however, able to do so; but looking at it from the train I formed an opinion which did not please me, and I determined to pay a visit to it. I did not do so for some days, but when I did I took a few dimensions, and then discovered that the bridge had not what I thought sufficient base enough to support it in accordance with the rules adopted by engineers.

6285. Did you make any comments about the bridge to any one? None whatever.

6286. Did you make any representations whatever about the bridge? No; I only spoke to a friend. In talking over the bridges on the southern line I said to him in a casual way that I had noticed the Glenlee viaduct, and that it seemed to be a little weak, but that I was not sure of it, and that I had not made any calculations, except a few figures which were altogether incomplete.

6287. Since then some tests have been made? Yes, I believe the Government have made some tests.

6288. Can you quote any authorities for the strength and tests of bridges? I do not quite understand you.

6289. Could you quote any authorities who would take the same view as you do about the Glenlee bridge? I have made some calculations, but it would be difficult to tell you how I have dealt with them, without pointing out the common laws and regulations and foundation upon which I base them.

6290. *Mr. Brown.* (To *Mr. Hoyle*).] Cannot you get generally from him his views with regard to the bridge, whether it is suitable for carrying the Baldwin engines or not.

6291. *Professor Warren.*] I will go through these calculations with him afterwards.

6292. *Mr. Brown.*] He has made certain calculations, and the result of these calculations shows him something. What is it. Do they show you that the result of your calculations is that the Glenlee bridge is weak? I will give you the calculations.

6293. *Mr. Hoyle.*] Do you know the weight of the Baldwin engines? I think it is about 90 tons.

6294. One class weighs between 91 and 92 tons, with a weight on the driving-wheel of 15 tons 6 cwt., that is the passenger engine; the goods engine is 97 tons, with a weight of 15 tons 9 cwt. on the driving-wheel. Now, having made your calculations with regard to the Glenlee bridge, do you consider that bridge strong enough to carry such an engine as the former travelling at the rate of 40 miles an hour? The estimate I make my calculation upon is Class 1, No. 483. I have made my calculations upon the basis of this engine.

6295. *Mr. Brown.*] What is the weight on the driving-wheel? The total weight on the driving-wheel would be equivalent to 63·6 distributed throughout, that is the weight resting the locomotive over one span of the structure.

6296. Had you not better ask him generally, *Mr. Hoyle*, if he can give you any evidence about the Baldwin engines and their suitability to our permanent-way. Ask him whether, assuming the weight to be what he states, his observations warrant him in saying that this bridge is safe for the Baldwin engine to pass over.

6297. *Mr. Hoyle.*] With your experience as an engineer, do you consider the weights I have mentioned as being those of the Baldwin engines would be too great for the Glenlee bridge to carry with safety? Yes, I do, most decidedly.

6298. Now can you give us any scientific reasons why these weights are too heavy? Yes, I can. I have asked myself two questions upon the strength of the girders to carry these locomotives, they are as follows:—"Are the beams designed and constructed so as to carry singly the greatest loads that can come upon them, and in accordance with engineering principles. 2. "Are the necessary factors of safety provided, in accordance with the Board of Trade regulations and recommendations, which regulations and recommendations the engineering profession has rigidly conformed to when designing structures of the class in question?" With regard to the factor of safety, I claim that these engines should have a factor of safety, say, of ten for a live load, and five for a dead load; that is upon the authority of the Board of Trade at home. In America the factor of safety is higher, but what it may be here I cannot say. I have made several calculations about the bridge, and I have found them anything but what they ought to be; and this might be said also with regard to other bridges in the Colony. Reference to the Bridges Commission

- Mr. A. Leaby. mission would show that there is a great variation in these things. We have also to ask ourselves whether, if this structure is capable of carrying the factor of safety of five for the dead load, at the present time, would it be capable of carrying it three years hence, for this is a permanent structure—not a temporary one.
- 17 May, 1892. 6299. *Professor Warren.*] Is it constructed of timber? Yes; but it would stand for a considerable time, in fact until the timber is worn out.
6300. *Mr. Brown.*] Is the bridge suitable for the Baldwin engines, not three years hence, but now? That bridge has been erected to carry traffic for the next two or three years.
6301. I do not say that they have not been built for five, ten, or fifteen years, but we have nothing to do with that. All that we can inquire about now is whether the Baldwin engines are suitable for the permanent-way, as it is at present, and not as it may be years hence.
6302. *Witness.*] My answer to that is, that it is not. The factor of safety that I have calculated to have been provided for this bridge is 2.18 instead of 5 in accordance with the Board of Trade regulations.
6303. *Professor Warren.*] Is that for a dead load? Yes; if for a live load it would be double that namely ten.
6304. *Witness.*] An important question in erecting bridges is the co-efficient of rupture, which I have taken to be 18 cwt. which gives the modulus of rupture as 12.096 lb.
6305. *Professor Warren.*] What is the timber? The timber I have estimated to be ironbark. The two beams are secured together, one on top of the other, and I cannot regard them as a compound beam.
6306. Are the beams constructed in the same manner as in the Wango Viaduct? No.
6307. What size of bolt have they? I think about an inch. I saw that they were not more than an inch and there was not a sufficient number of keys.
6308. You know what was the span of the bridge? Twenty-one feet.
6309. *Mr. Hoyle.*] You said you have had some experience of tests of iron and steel, I think it is understood that these engines are not now run on the southern line, and the reason why I ask you about the Glenlee Bridge is because the exigencies of the Department may make it necessary to run these engines over that line at some future time. I wish to point out that we have had evidence to show that there are a number of turned rails over which these engines are repeatedly passing, and evidence has been produced to show that there has been a loss of weight of about $1\frac{1}{2}$ lb. per yard, due to the continuous traffic upon them. The iron rails when new were 75 lb. per yard, and the sleepers are spaced at the curves from 2 ft. to 2 ft. 7 in. or 8 in., and on the straight from 2 ft. 8 in. to 3 ft. 3 in. Now, taking the weight of the engines that I have already indicated to you into consideration—
6310. *Mr. Fehon.*] I do not think there is any evidence about the sleepers being 3 ft. 3 in. apart on the straight.
6311. *Mr. Hoyle.*] I have measured them myself.
6312. *Mr. Fehon.*] Well, go into the box and give evidence about it.
6313. *Mr. Brown.*] I do not think any evidence has been given that the rails are 3 ft. 3 in. apart.
6314. *Mr. Hoyle.*] Well, 3 ft. 1 in. has been sworn to; but taking into consideration these facts, and that the material has been worn on one side and the rail turned over, do you consider it right and safe to take engines of such a weight over them? I should certainly say not. I say it is not safe.
6315. Will you kindly examine that rail; it is the one that was broken in the recent accident? [*Here witness examined the rail.*]
6316. I would like to ask you whether, having seen the fracture in it, you consider that rail to be of good iron? Yes; I think it is ordinarily good iron.
6317. Do you consider that that rail has been broken by a perpendicular or a lateral strain? I would like to know where the rail was broken?
6318. It was broken just at the commencement of or a short distance beyond the commencement of a curve. Now having seen the rail and having been informed of its position at the time of the accident, do you think it was broken by a lateral or perpendicular strain? To answer that question I would require to make a systematic examination of the rail, and that would be a matter of three or four hours. I should want to know where the curve commenced and where it ended, and where the breakages were, and I should also want to thoroughly examine the iron with regard to its quality. I could not form an accurate opinion by merely looking at the rail, that would be simply working in the dark, but I should be able to tell you something about it in an hour or an hour and a half. There are many matters in connection with locomotives going over a rail that should be taken into consideration, specially when the engine is running into a curve. It may be that this was part of an S curve, and there is nothing to prevent the engine being thrown from the one rail sharply against the other.
6319. It was not on a reverse curve I think, in fact I am sure it was not? However, I could not answer that question unless there was a drawing of the curve before me. I should want to get the exact radius of the curve, &c., and with so little information before me it would be impossible for me to say exactly what caused the fracture.
6320. It has been sworn that the curve was taken at the rate of 25 miles an hour, if not a greater speed. Now taking again into consideration the weight of the engine and the weight on the driving-wheel, do you think it would be safe to take an engine of such a weight into a curve of 10 or 12 or 8 chains at a rate of 25 miles an hour? No, not with an iron rail of 75 lb. weight and sleepers placed as you say from 2 feet 8 inches to 3 feet 2 inches apart. The sleepers at a curve should not be more than 20 inches apart from centre to centre, and here I understand they were about 3 feet apart.
6321. I wish to ask you another question, and it is relevant to the axle. Do you consider, having had some experience in the manufacture of iron, that when axles are being ordered tests should be provided for them, irrespective of the repute of the firm providing them. When ordering axles, which are so vital a part of an engine, do you as an engineer, consider that tests should be specified for them without respect to the repute of the firm supplying them? Most certainly. If I were ordering engines I should, irrespective of the reputation of the firm, provide for tests; and I should also see that the men who inspected the engines during their construction were trustworthy. My reasons for doing so are these—that I find that, as a rule, foremen in large works consider it their business to get out the work as cheaply and as quickly as possible, and will pass over little defects which do not appear to be of much account to outsiders, but which, if an expert were called in to thoroughly examine the work, he would, probably, consider to be of very great importance. Take, for example, the accident which you referred to just now. It may be that the fibres of the metal were strained, and in the case of an axle whose fibres had

had been strained, it would probably be unsafe, so that it is no use to imagine that the best firm in England or America may be trusted without having some check placed upon it. Such firms are certainly not trusted by the railway companies in England. There every railway company has a man whose duty it is to inspect the making of the engines. He watches over every job, and his position is held by the faithful performance of his duty to his employers. The best men they have are selected for this duty of inspection during the making of the locomotives in the shops of the contractors. Of course in places where the railway companies carry out their own work it is a different thing altogether. I must decidedly say that I would not order any locomotives, or axle, or any part whatever without having tests provided, and I should most decidedly specify those tests.

Mr. A. Leahy.

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6322. Supposing that whilst running these engines you discovered that any of their axles broke, would you order the removal of the whole of the same class of axles from all the engines furnished with it, or would you allow the engines to run any longer? Do you mean if any one of them broke?

6323. Yes, if you discovered that any of these axles broke. You must understand that when the axles of the bogies broke they were all removed, but afterwards a tender axle broke, and the other tender axles were permitted to remain. Now would you have allowed these tenders to run any longer without having the whole of the axles removed? I might take that axle and test it; but in the meantime I should look after the others.

6324. *Mr. Brown.*] If some of these axles have shown sufficient defects to warrant the removal of a portion of them, would you as an engineer, knowing of these defects remove the whole of them? Certainly.

6325. *Mr. Hoyle.*] Then you would stop these engines at once, until all these axles had been removed? Certainly.

6326. You are aware, I presume, that sometimes when tests are made, one of a number only is tested. Thirty or forty may be brought in and one taken out indiscriminately and tested. Would you consider that to be a satisfactory test of the material contained in the rest; that is taking one indiscriminately would you take the rest as up to the balance of that one? Are you supposing that certain tests must be made to the axles you are going to use?

6327. Yes? It would be impracticable for a man to test every axle.

6328. But we are supposing that there are thirty or forty in a heap together, and the person who comes to test them takes one indiscriminately out that heap and tries it. Would you take that to be a sufficient guarantee for the rest; if the one were found good, would you take it for granted that the rest were equally good? I cannot quite follow for this reason—if these axles were made of steel and were submitted to specified tests, well and good if one axle stood it, but the day's work constitutes perhaps twenty axles. The way the work is done in manufacturing these axles is as follows:—First of all the material is selected, and every ingot is marked after being turned out of the crucible, and every process is closely watched until the metal is finally turned into an axle. If after this has been done upon testing it is found to be wanting, the whole of the axles which have been made of the same heat may have to be put aside, and a fresh lot made, but supposing the whole of that process has been satisfactorily passed through, you have the completed axle. I cannot see, why then, if you tested one by chance selection and it was not satisfactory, you could not take a second and test that, and so on.

6329. *Mr. Brown.*] Supposing there are fifty axles all ready for testing, and you take one and it answers the test, would you accept that one as a sample of the rest? I would take one per cent., assuming that all the previous tests and inspections had been satisfactory. It places an engineer in a queer position when he finds one axle in fifty to be wrong.

6330. *Professor Warren.*] You mean you would take 1 per cent. of the day's work? I would take one in fifty.

6331. You would object to take a batch of axles unless produced in a certain time, and then you would take 1 per cent.? Yes.

6332. If the first axle selected passed the test you say that you would risk the rest? Yes.

6333. The same test you would apply to boiler-plates and material in general, I suppose? Yes.

6334. *Mr. Hoyle.*] You have had no experience of our other bridges on the western line? No; except in the construction of the bridges here I have had no experience of them.

6335. With the 71-lb. steel T rail and the sleepers spaced as I have indicated do you consider that it would be safe, taking into consideration the bearing of the rail on the sleeper itself, and not on the chair, would you consider it to be safe to run these locomotives? It all depends upon the speed.

6336. Taking the speed of the goods train to be 18 miles, and that of the passenger train not more than 40 miles an hour? If the sleepers were placed 2 ft. 7 in. apart, at the most, I should say it would be fairly safe, but I would like a heavier rail, especially at the curves.

6337. *Mr. Brown.*] Mr. Hoyle wants to know if it is safe.

6338. *Professor Warren.*] It is not on the question of economy.

6339. *Mr. Hoyle.*] Do you think, taking into consideration all the other things I have indicated, that it would be safe to run these engines over a 71-lb. T rail? I think it would be safe on the straight, but I am doubtful about the curves. I could tell if I had all the data before me. I think it would be perfectly safe on the straight if the sleepers were not more than 2 ft. 7 in. or 2 ft. 8 in. apart.

6340. Have you had any experience of the testing or the straining of rails? Yes, I have seen thousands and thousands of rails tested.

6341. Well, what do you think of the rail you have seen in this room, it has been turned twice or run on both faces, what do you think should be the test drop of a rail such as that, with a monkey of a ton weight, what do you think it should stand.

6342. *Professor Warren.*] In foot tons.

6343. *Witness.*] The test would be about 4 ft. with one ton.

6344. Do you mean the steel rail? No, that is the 75-lb. rail. It would be about 4 ft. without fracture.

6345. Not repeated? No, just one blow.

6346. What would it take to fracture it? About double that. A little more than about 9.

6347. Nine-foot tons? Yes; I am speaking now from memory. I have not done any testing for seven or eight years.

6348. *Mr. Hoyle.*] Have you ever tested rails such as these? Yes.

6349. And from your experience that is the test they should stand? Yes.

- Mr. A. Leahy. 6350. What should be the test then that a T rail should stand, the ordinary T rail? Well, that depends upon what we are testing for in the first place. Are you testing simply for breaking.
- 17 May, 1892. 6351. What should be the breaking drop test of a T rail 71 lb. steel? Well, I could hardly give you that from memory.
6352. Can you give us any rough idea? To break the rail?
6353. Yes? I should say about 30 tons; but I would not bind myself in these figures. I am speaking from memory, but I have no data to go upon.
6354. I wish to ask you a question. Have you ever tendered for the manufacture of rails here? Yes; to re-roll the old rails of the Colony, about some six years ago.
6355. *Professor Warren.*] But the Eskbank Company got it? Yes; another company and the Eskbank Company. I believe I was by 6d. per ton the lowest tenderer.
6356. *Mr. Brown.*] We do not want to go into what the tender was.
6357. *Mr. Hoyle.*] Did you ever tender for the manufacture of steel rails here? It was my intention in laying down the plant for relaying the road, had I got the tender, to lay down a plant for steel rails.
6358. *Mr. Fehon.*] How long have you been in this country? About seven or eight years.
6359. I think you said in your evidence that you had not been in the employment of a railway company? Yes; but I have been constructing railways all the same.
6360. What railways have you been in? I have studied on the London, Chatham, and Dover Line.
6361. I did not ask you what companies you have studied with, but in what companies you had been employed? I have been employed on the London, Chatham, and Dover.
6362. What did you do there? I was employed in laying down about a quarter of a mile of patent permanent-way.
6363. Anywhere else? I was engaged in Central America, on the Lagaira and Carracas Railway.
6364. What were you doing there? I was acting as assistant engineer, and had the inspection of the works.
6365. Have you had any railway experience in this country? No; not beyond constructing railway bridges.
6366. What railway bridges have you constructed in this country? I referred to the iron bridges. I mean that I made them.
6367. Well, which of them have you made? Well, I think the Black Creek Bridge was the last one I made. That is somewhere near Newcastle. Then, besides that, we built some two or three bridges for the Railway Department.
6368. Whom were you with? I was with Ostermeyer, Dewez, & Company (Limited). I was their engineer.
6369. But they imported all their bridges? No; only one or two. That was just as I landed here. After that I took care that they did not import any others.
6370. You say you are a draftsman in the Roads and Bridges Department? Yes; an "extra temporary" hand.
6371. You say that with regard to the Glenlee Bridge you were unsettled in your mind as to what to do, and you consulted a friend. Who was this friend, if you do not mind telling us. Who was he? I do not think I should name my friend unless I received his permission to do so. He is sitting at this table, and I am not afraid of mentioning his name, if he has no objection. May I ask him the question?
6372. Is it Mr. Foote, of the *Sunday Times*? I never instructed him or anyone else to mention the matter in the Press.
6373. Did you mention it to anyone else. Did you not speak to the Colonial Treasurer about it? Yes.
6374. Well, what was the result? I simply called upon Mr. See.
6375. Well, tell us as briefly as possible what took place? I told him that I desired to speak to him on the subject of the railways, with reference to a railway bridge on the Southern Line. He replied, "Had you not better go to the Commissioners." I said, "I have a reason for not going to them, and my reason is that I should not place my charges before them as a Civil Servant, and if you will allow me I shall make the charges to you, I only want you to see fair play, because I have, as a member of the public, to travel over that viaduct in order to reach my land on the other side." Mr. John See said to me sharply, "Have there ever been any charges brought against you in the department? I said "no, Sir, never in that department or any other." The result of that interview was that between twenty-four hours I was asked to meet the Commissioners and the engineer, Mr. Darley, Mr. Hickson, Mr. Deane, and I believe Mr. McLachlan were there.
6376. *Mr. Brown.*] At all events you met a big crowd of these gentlemen.
6377. *Mr. Fehon.*] Do not you think you are the greatest engineer in the Colony? No; but I do think I have had a very fair training.
6378. Did you not consider these gentlemen the leading engineers of the Colony? Certainly.
6379. And did they not tell you that you were altogether wrong in your idea of the Glen Lee Bridge? No, they did not. I wish they had, then I would have had something to say about it.
6380. Suppose Sir John Fowler had said that the Glen Lee Bridge was quite safe? I presume that I could produce evidence or state facts that might show him to be in the wrong.
6381. *Mr. Brown.*] What is your opinion, you know you came here as an expert? I did not come here on my own account.
6382. But you are here as an expert? I am not aware of that. I do not know who called me. I have never seen Mr. Hoyle to speak to until I was called here.
6383. Well, will you set your opinion against Sir John Fowler, if he said this bridge was safe? Yes.
6384. *Mr. Fehon.*] And Mr. Deane, and Mr. Hickson, and Mr. Foxlee, and Mr. Darley, you would set your opinion against theirs? I would want to have their figures. There is no use in taking a man's word. Let us have the facts and the figures upon which he bases his opinion.
6385. Why did you not send your figures to these gentlemen? You sent for me at 11 o'clock, stating that you wished me to call at 12 o'clock the same day. I was on duty at the time, and my private house is at Fairfield. When present I said that I was prepared to give you a copy of my calculations. I asked you to produce the drawings of the bridge, and you would not produce them.
6386. How long were you with C. de Berque? Two years, I served my time there. I was under the greatest engineer of the day.
6387. *Mr. Brown.*] Where were you employed? I did not say I was employed there.

6388. *Mr. Fehon.*] What is the highest position you ever held? The highest I held is that of engineer, *Mr. A. Leahy.* at £1,000 a year, and more than that, I could get it again if I returned to England.
6389. Would not that be better for you to do than remaining here as a draftsman? I have family reasons *17 May, 1892.* for not returning home.
6390. Did you ever tender to supply a locomotive in this Colony? Yes; that was in the year 1887.
6391. You were the lowest tenderer? I do not think I was; but I think I was very near it.
6392. Yes, the lowest? You do not know why your tender was not accepted? No.
6393. Have you ever had anything to do with locomotives here? No.
6394. Or permanent-way? No.
6395. Then your experience must be a very old one, yet you come here as an expert, and give your opinion about the rails and permanent-way when you know nothing about them? *Witness:—Mr. Chairman,* I appeal to you.
6396. *Mr. Brown.*] That is not fair, *Mr. Fehon.* He comes here to give his evidence before the Commission for whatever it is worth, and you have no right to comment upon it now.
6397. *Mr. Fehon.*] Very well. You have looked at that rail, and you have given your opinion as to the drop test it could stand? I am only speaking from memory.
6398. What weight dropping 12 inches should break that rail? I should say possibly from 20 to 22 or 23 tons.
6399. *Mr. Fehon.*] You think it ought to stand that before breaking? No; I think that should nearly break it.
6400. *Professor Warren.*] Will you tell me the span of the Glenlee bridge? I think there are 19 spans; but I would not swear to that. They have 21-foot centres. Three beams in the centre. The beams in the span are composed of six 12 x 12 ironbark timber, and corbels. These beams are not compound but only laid on top of the other.
6401. Then they must be considered as two single beams? I will leave that to you to settle.
6402. According to that they would not be strong enough? If they were compound beams they would be about a third more than my estimate which is 49·35 tons as the ultimate breaking strength of each of the beams, and the ultimate breaking strength of the whole of the beams in one span would, I estimate, be 296·1 tons.
6403. Supposing that they are two single beams, would they not be twice as strong if you put in the necessary shearing and bolts? Yes, I agree with you; but they are not compound beams because they do not contain the necessary amount of keys to secure them together.
6404. The proper amount of shearing you mean? Yes.
6405. You have assumed in making your calculations that the modulus of rupture is 12·096 lb.? Yes.
6406. Well, what weight would the bridge carry per foot, assuming the modulus of rupture to be right? 136·24 tons would be the maximum load which could be brought upon the beams, but the ultimate breaking strength of each of the beams provided is equal to 49·35 tons, and the ultimate breaking strength of the whole of the beams in one span equals 296·1 tons, therefore the safe breaking strength of a complete span of the structure with a factor of safety of 5 equals 59·5 tons. The breaking strength of each of the beams provided, I have given as 49·35 tons.
6407. That is the distributed load? Yes.
6408. I think I saw certain wheels drawn upon your diagram. I suppose you have taken the bending moments of these? I have taken the centre of gravity of the whole and put it in the worst position for loading.
6409. Then the total load which should come upon the structure or that portion of it would be about 9 tons? Yes, I think so.
6410. You say that each of these beams will take 49·35 tons, and that is distributed, and six times that would be the strength of the bridge, let us call it 50 tons, then roughly we will have 300 tons as the carrying strength of the bridge? Yes; I make it 296·1 tons.
6411. What is the weight of the superstructure itself? Nine tons, each span, in fact a little over, but I have taken everything in favour of the Commissioners. The only difference would be the modulus of rupture, and that I would not take in practice at too much.
6412. Nine tons is the weight of the beams then, and what kind of deck is there? The planks are about 14 inches apart, I think, and they are about 8 x 8 or 10, and the rails are laid on this longitudinally; there are rail bearers underneath the rails, about 13 x 8 or 9 each.
6413. Well, you make out that this bridge will carry about 300 tons, that is 63·62 tons is the distributed load at the centre of the beam, and the distributed dead load due to the locomotive you estimate at 127·24 tons, and the load due to superstructure at 9 tons? Yes. That gives a total load of 136·24 tons. The live load of the engine is equal to 63 tons and twice the live load is equal to the dead load.
6414. 15 tons 9 cwt. is the weight on the driving-wheel, do you know what is the equivalent bending moment to that? Yes, the maximum moment is 167 tons at the centre of the beam.
6415. Taking the 63·62 tons distributed load and dividing it into 300 that leaves you about 4 tons? Yes.
6416. I do not say that is the correct way in which to treat the matter;—what do you make out your factor of safety to be in these calculations—never mind about doubling the live load? My factor of safety, drawn from these calculations, is 2·18 and by doubling the live load it would be slightly more than that; that is to say, if I took the dead weight. These calculations are made on the basis of Professor Ranken's rules, the only ones by which I know these calculations can be made.
6417. 2·18 is not a large factor of safety? No, I think not.
6418. I shall be glad to look at that bridge. At present the calculations show that it is weak. In the calculations the witness may not have taken into consideration all the elements he should have done.
6419. *Mr. Fehon.*] The question of this bridge scarcely comes in the scope of the inquiry; but as the question has been raised as to its strength, we shall put *Mr. Foxlee* in the box, and he will clear up anything that requires explanation.
6420. *Mr. Brown.*] This is *Mr. Hoyle's* last witness, and we look upon this matter as an important one, as it is possible that the Baldwin engines may have to be carried over this bridge.
6421. *Mr. Fehon.*] You went over it on Sunday on a Baldwin engine.
6422. *Witness.*] I did not say that the bridge would not carry the Baldwin engine, but I raised the question whether there is not a doubt with regard to the public safety. Would, for example, an insurance company take the risk?

Mr. A. Leahy. 6423. *Mr. Brown.*] They would take it if you gave them the premium they wanted; that is the only question.

17 May, 1892. 6424. *Professor Warren.*] I understand that your factor of safety, 2·18, is arrived at by adding the live load to the dead load? That factor of safety is the dead load. The Board of Trade regulation gives 5 as the factor of safety, but my calculations with regard to this bridge show it only to have a factor of 2·18. 6425. Never mind the Board of Trade regulations, I think they are generally recognised to be a little out of date.

6426. You consider that an iron rail is unsafe with the sleepers at their present distance apart, but that steel rails would be safe with sleepers about 2 ft. 7 in. in the centre? Yes.

6427. You were asked some questions about axles—could you tell me, without referring to your notes, what tests you would specify for ascertaining their quality? I have made no notes. I did not know that I was to be called here till last Thursday; this is my first day out since I have been ill—indeed, during the whole morning I did not know whether I should be able to reach here. I have had no opportunity of making preparations for examination, and the calculations which I have made with reference to this bridge had nothing to do with this Commission at all. I have therefore made no notes, but I shall answer any questions put to me, as far as I am able, with pleasure.

6428. *Mr. Hoyle* asked you some questions with regard to testing of axles—now, what tests would you prescribe, first of all with regard to steel? For steel I should expect the axle to double up whole without a sign of fracture, and in the event of a railway accident occurring through the breaking of an axle, I should want it to do exactly the same thing; no matter whether the axle was of steel or iron, the same test should apply to both. In steel it would be very important that it should contain a certain amount of carbon, perhaps a little more than is usual for some other kinds of steel. Steel axles should have 5 of carbon.

6429. Would you subject them to tensile tests? Yes; I should apply a test of 23 to 28 tons with a contraction of area of about 20 per cent. With regard to iron, the tensile test would be about the same, perhaps a little less—say from 23 to 26 tons.

6430. And the ductility would be the same? Yes; I would require a test equal to that for Bowling or Low Moor iron.

6431. Looking at the rail taken from the railway accident, could you say whether it is good or bad material? No; it would take me several hours before I could answer all the questions necessary to be answered. The fact of a rail being turned is a very good guide to what may follow.

6432. *Mr. Hoyle.*] About the strain on an iron and a steel rail—what difference do you consider there is between the strength of steel and iron;—for instance, that rail is 75 lb. of iron to the yard. Now, would the strength of a 71-lb. steel rail be equal to that, or greater? It would be equal in strength, but it would not be equal in section, and it would not do to make a smaller section of it. In the case of a steel rail it would have to be a smaller section than in the case of an iron rail.

6433. *Professor Warren.*] Taking the ordinary steel used for rails and the ordinary iron, what is the difference of strength? There is not very much difference. I have known some good iron rails to be better than a great many common steel rails. Take, for example, the little ferrules for stopping the tubes of boilers. You can take some of our steel rails and make the finest ferrules by cutting off the flanges. You can get steel of almost any quality—some of it will break off like glass, and some twist off like putty.

6434. *Mr. Hoyle.*] Do you consider the continual strain on iron reduces its power of resistance. For instance, if you put a T rail on the sleepers and make the space 3 feet apart, as is at present the case, with our iron rails laid on the straight, what would be the resistance of steel compared with that of iron;—would the resistance of the steel be greater than that of the iron? Yes, in the proportion of about 3 to 1, that is to say, that if in the one case you require 10, in the other you would require 30.

6435. *Professor Warren.*] If the tensile strength of the iron rail would be 20, then the tensile strength of the steel rails would be 60;—is that what you say? No; I made a mistake—the tensile strength should be about 32 tons. I thought you were talking about the drop test.

[This closed *Mr. Hoyle's case.*]

6436. *Mr. Brown.*] I think the Commission should tell you, *Mr. Hoyle*, that, generally speaking you have produced no evidence with regard to the last part of your allegations—namely, that these engines are not rendering the services which they were expected to perform. There has been indirect and inferential evidence given touching upon this point, but no specific evidence has been called with regard to it.

6437. *Mr. Hoyle.*] I understand that.

6438. *Mr. Brown.*] I thought that, under the circumstances, I should call your attention to it.

6439. *Mr. Fehon.*] The Railway Commissioners ask for an adjournment until to-morrow. The Chief Commissioner is engaged on another Commission, and he expected to be there to-day, but, unfortunately, *Mr. Schey* was sick, and, contrary to his expectations, *Mr. Eddy* is relieved from attendance there to-day. Anticipating that he would be at the other Commission, however, he was prepared to go on with our case before you to-morrow, when the other Commission will not be sitting. He will address some remarks to this Commission on the general question of the inquiry, and then we shall proceed to call evidence in support of our statements, but I would ask you now, inasmuch as the strength and construction of the Glenlee bridge has been brought into question, whether I may not in the interim call *Mr. Foxlee*, who will lay before you, so that it may be made public, a statement, supported by the very best evidence that can be obtained in this world, in regard to the strength of the bridge, so that whatever may have been said on the subject may be put right. With your permission, I will ask *Mr. Foxlee* to come forward and lay certain facts before the Commission.

6440. *Mr. Brown.*] I do not think there can be the slightest objection to either course. The adjournment, of course, we shall grant at once, and we shall be glad in the mean time to hear *Mr. Foxlee's* evidence with regard to the Glenlee bridge.

Mr. Foxlee recalled:—

Mr. Foxlee. 6441. *Mr. Fehon.*] You are responsible for the designs of all bridges constructed under instructions by the Railway Commissioners? Yes.

17 May, 1892. 6442. You prepared designs for the bridge at 37 miles 75 chains near Glenlee? Yes.

6443. Have you any doubt as to the suitability of that structure? None whatever.

6444. You have seen certain Press strictures in regard to the construction of that bridge? Yes; I saw ^{Mr Foxlee.} some in a Sunday paper some time ago.
6445. *Mr. Brown.*] You may also add that you have heard the evidence that has been given in regard to ^{17 May, 1892.} it this afternoon? Yes.
6446. *Mr. Fehon.*] And as a result of the Press strictures was not a Board appointed to inquire into the construction of that bridge? Yes, a Board was appointed for that purpose.
6447. Who were the members of that Board? Mr. Deane, the Engineer-in-Chief for Railway Construction, Mr. Darley, Engineer-in-Chief for Harbours and Rivers, Mr. Hickson, Engineer-in-Chief for Roads and Bridges, and myself.
6448. Have you that report? Yes, I have it here.
6449. Would you kindly read it? Certainly:—"At the request of the Railway Commissioners we have carefully investigated this matter, making all necessary calculations with that view, and have no doubt of the complete stability of the bridge in question in every respect.—C. W. DARLEY, R. T. HICKSON, H. DEANE, W. T. FOXLEE."
6450. *Mr. Brown.*] You put that in as evidence, do you not, Mr. Foxlee? Yes.
6451. *Mr. Fehon.*] Was it not stated by the newspapers in question that designs would be forwarded to the engineering journals in England? Yes.
6452. And, as a result, were not plans and particulars of the bridge sent to Sir John Fowler for his information? Yes, sir.
6453. Have you got Sir John Fowler's report? I have a copy of Sir John Fowler's report here. It is a short report only—only a few lines; it is as follows:—"Sir John Fowler to Agent-General. Sir,—I have to acknowledge your letter of the 22nd instant, enclosing letter from the Secretary of the Railway Commissioners, dated 15th February. I have examined the drawings of the bridge referred to in the letter of the Commissioners, and assuming the workmanship to be good, I am able to say that the design is satisfactory and sufficient, including the provision against wind pressure.—I am, &c., JOHN FOWLER."
6454. So that Sir John Fowler, Mr. Deane, Mr. Hickson, Mr. Darley, and yourself all report that the structure is perfectly safe? Yes.
6455. Were you present at the test of the bridge? No; I was not present.
6456. Have you reported the test? Yes; may I read it.
6457. *Mr. Brown.*] Certainly; who made the test? Two of my assistants tested the bridge, and this is the report they sent to the Secretary:—"We beg to report that yesterday, the 3rd instant, the traffic was diverted over what will be the up-road between 37 miles 37 chains and 40 miles 3 chains, and all was satisfactory. Owing to the comments that have been made regarding the strength and stability of the timber viaduct at 37 miles 75 chains, special attention was paid to this, and very careful tests were made laterally, transversely, and longitudinally, with a train consisting of a new Baldwin Consolidation engine, No. 495, and two suburban American carriages. These tests give highly satisfactory results, and we are satisfied that the viaduct is capable of carrying, with the utmost safety, the heaviest load possible to be brought upon it. Diagram of tests being attached, signed: James Fraser, Robert Kendall, David Simpson." I may mention that the maximum deflection of one span was a little over a third of an inch. They also tested the bridge by rushing down the incline, and putting on the brake, thus stopping the train suddenly on the bridge, and the longitudinal movement was nil. That is the result of the test.
6458. And that was one of the heaviest engines on the New South Wales Railways? Yes; it was a Consolidation goods engine.
6459. *Secretary to the Railway Commissioners.*] It was the heaviest engine on the railways.
6460. *Mr. Fehon* (to Witness).] And you consider that a highly satisfactory result? Thoroughly so.
6461. *Mr. Brown.*] You heard the evidence given by Mr. Leahy? Yes.
6462. Was it correct from a scientific point of view? No, it was not, in my opinion.
6463. *Mr. Hoyle.*] Have you had any independent tests of these bridges from gentlemen outside the department, Mr. Foxlee? No.
6464. The gentlemen whose names are here on these reports are departmental officers? Yes.
6465. You said that this matter was submitted to Sir John Fowler;—was the plan of the bridge submitted to him? Full details of the structure, as carried out, were submitted to him. We would not content ourselves by sending to him merely a tracing of the drawing of the bridge; we had the fullest details worked out for his information. Indeed, for that purpose I sent some of my best assistants over the ground to take very careful measurements, and then to plot them, and from that drawing tracings were sent to Sir John Fowler.
6466. The remarks that I am going to make, gentlemen, I wish to explain, do not carry with them—at least, it is not my intention that they should carry with them any reflection, but I should like to ask you, Mr. Foxlee, whether you consider Sir John Fowler the best authority in England to whom this question could have been submitted? Yes, I certainly do; I consider him one of the best bridge engineers in the world, and seeing that he is the designer of the Forth Bridge, amongst numerous other structures, I think I am perfectly safe in making that statement.
6467. Would you now have any objection to supply me with a copy of the tests you have had made? That is a matter for the Commissioners.
6468. *Mr. Brown.*] Have not the tests just been handed in.
6469. *Mr. Hoyle.*] Yes; but those copies belong to the Commissioners.
6470. *Mr. Brown.*] Yes; but you will have a copy of them procured for to-morrow.
6471. *Mr. Fehon.*] The reports are perfectly public now, only I have an objection to the way in which the matter was first brought on.
6472. *Professor Warren* (to Witness).] Is not the design of this bridge somewhat similar to the viaduct that Mr. Deane has got out—I mean to say that it consists of three beams? They are very similar.
6473. I take it that these wedges are 3 by $1\frac{1}{2}$, and that they bear the shearing stress? Yes, they are always carefully wedged and tightened up.
6474. That is 3 by $1\frac{1}{2}$ and 12 deep. What is a safe shearing stress per square inch? I have not my calculations with me.
6475. I am not asking for the actual shearing stress, but here is a wedge which will obviously shear at a certain place. I take it that it is the best iron bark you can get.
6476. But you have to resist the horizontal shear with these wedges? Not altogether so; you see they are bolted right through, and then there is the friction of the timber beams and the shearing of the bolts.
- 6477.

Mr. Foxlee.

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6477. And to resist the vertical sheer, you have the iron bolts? Yes; every transome is bolted through.
6478. But what do you allow per square inch sheering resistance on iron bark? I have not my calculations with me now, and do not remember them.
6479. This bridge may be safe, but those wedges are not safe, I am certain. They are nothing like large enough? But there are the bolts.
6480. Well, even so the wedges are too small beyond a doubt. I should not put them in. Your wedges are 3 by 1½, and I should certainly think that 10 by 3 would be nearer the mark. This is a question that I put to Mr. Whitton before he left, and he agreed with what I am saying now? Yes; but you weaken your beams enormously by putting in such large wedges.
6481. I do not for one moment mean to say that the bridge is not strong enough. I have not gone into the subject sufficiently to enable me to form an opinion on it? I say you weaken your beams enormously by making your wedges so large.
6482. Yes; but you weakened your power there as it is? Yes; but you treat the beam as a continuous girder.
6483. But how can you treat it as a continuous girder, when it is joined here? Under each beam.
6484. But most of them, I take it, would be joined over the piers? Yes; they are joined alternately under and over.
6485. Of course you cannot treat a timber girder as continuous, unless it is actually continuous throughout;—you cannot make joints unless you put iron plates on? We have treated it as a single span.
6486. Of course I do not for a moment dispute the result that you have arrived at;—you say that your assistants were very well satisfied with the bridge on account of the deflection? Yes.
6487. What does the deflection tell beyond the stiffness of the bridge? It tells you the stiffness undoubtedly.
6488. A beam 12 inches deep might deflect a certain amount, and a beam 6 inches deep might deflect more with the same load;—how did your assistants connect the stiffness with the strain;—of course it can be done, but they speak so strongly in reference to the deflection that one cannot help pointing out that after all it only shows the stiffness of the bridge. A gentleman the other day giving expert evidence, made very strong remarks about the stiffness of a bridge, and he did not know what load was on the bridge at the time? But if he had been there himself and taken deflections, he might at once have said that the bridge was not stiff enough.
6489. Well, there is no other question that I can ask Mr. Foxlee in relation to the bridge at present, because he has not got his calculations here.
6490. *Mr. Brown* (to Witness).] You heard the evidence that Mr. Leahy gave just now, and you heard him say that he had an interview with you and some other gentlemen with regard to this particular bridge? Yes.
6491. Did you give him an opportunity of putting before you his complaints with regard to the want of stability in the bridge? Yes.
6492. When questioned upon the subject he seemed to complain that he was hurried into the question without being armed with the necessary papers, which he said he had left at home;—he seemed to complain that when he came before you gentlemen he did not get the attention to which he was entitled? He received every attention. This drawing was placed before him, and he was asked to say where the bridge was weak, but apparently he could not do it. He would only reply in very general terms. He could only say that it would break, that it would tumble down, and so on; but when we asked him why he could not tell us.
6493. *Mr. Brown*.] Did you give him any other opportunity of proving his case—of bringing before you any papers of which he was possessed, or did you then set to work to decide the matter for yourselves? We gave him every opportunity, and he said that he had not his calculations with him.
6494. Did you offer to delay your judgment at all in order to enable him to obtain the papers? I think I am right in saying that the Commissioners asked him to send in his calculations.
6495. They invited him to send in any information of which he was possessed? Oh, yes; I am sure of that.
6496. And on this information you set yourselves to decide whether the bridge was safe or not? Not that we had the slightest doubt about it.
6497. No; but at all events you did make inquiry? Yes; it was after some articles appeared in the Sunday paper to which I have previously referred, I believe.
6498. After the articles appeared in the Sunday paper you sent these gentlemen out to inspect the bridge, and also the details of the structure home to Sir John Fowler? We made our own report, but as the comments to which I have referred continued, and as the paper threatened to send reports of the matter to the various engineering journals in England, we thought it just as well to anticipate anything they might do by sending the fullest possible details to Sir John Fowler, who, being on the spot, would of course know what was the best course to take if comments upon the matter were made in the home papers.
6499. And the result was satisfactory? Eminently satisfactory.
6500. *Professor Warren*.] Do you not think it would have been more satisfactory if you had sent the drawings home to Sir Benjamin Baker to examine;—of course I do not wish to infer that Sir John Fowler's authority was insufficient, but we all know how much work he has, and the possibility of his handing the matter over to an assistant? As Sir John Fowler is the Consulting Engineer to the New South Wales Government, and is in such intimate relationship with the Agent-General, we thought that the best thing we could do was to send the details to him.
6501. I should like to say when this question of bridges crops up again that I shall not ask any general question with regard to them; I will either ask no questions at all or else I shall go into the matter thoroughly; it is not sufficient to come here and say this bridge is good because so-and-so says it is; no one doubts that Sir John Fowler is one of the first engineers of the world, but if any evidence is given it ought to be given in such a way that we can publish it so that the world at large can see that the bridge in question is all that it should be, and in order to know that I should require to be told the factor of safety that you have adopted? I think I am right in saying seven.
6502. That applies to all bridges, I suppose;—I am very sorry to have to go into the matter at all, but it seems to me that we cannot escape from it, inasmuch as the Baldwin engines have to pass over these bridges? We shall be glad to put these drawings in for your information.

6503. *Mr. Hoyle.*] As you had no doubt about the safety of this bridge, would you tell us why you submitted it to Sir John Fowler?
6504. *Mr. Fehon.*] I think I can answer that question better than Mr. Foxlee.
6505. *Mr. Brown.*] Yes, Mr. Fehon; but it was Mr. Foxlee's answer that Mr. Hoyle wanted.
6506. *Mr. Hoyle.*] Yes. (To Witness:.) As you had no doubt about the safety of this bridge, will you tell us why you submitted it to Sir John Fowler? I have already answered that question; because the journal that I have referred to stated that it was going to invite opinions from the engineering journals of Europe, and the Commissioners thought it a desirable thing that somebody at home should be in a position to state facts. It was not that we had the slightest doubt about the stability of the bridge.
6507. Then what is the factor of safety that you allow in bridges here under your control? A factor of safety, as I told Professor Warren, of about seven. I think that is so, though I am speaking from memory.
6508. Is that for a live or a dead load? If you do not mind me telling you, as you are a layman, the factor of safety means how many times stronger the bridge is than it need be to resist the greatest weight than can ever be placed upon it.
6509. *Professor Warren.*] But you would not allow the same factor for a live load as a dead load? No; but seven is what we take as the factor of safety for both.
6510. That is to say that you adopt seven as your mean factor for both live and dead loads? Yes.
6511. *Mr. Brown* (to *Mr. Hoyle*).] Do you want to have the drawings of this bridge included amongst the papers of the Commission, because, unless you think it necessary that they should be included, I would not increase the volume of evidence and appendices with them, we do not wish to produce a more bulky volume than necessary.
6512. *Mr. Hoyle.*] No; I have no wish for the publication of the design of that bridge.

Mr. Foxlee.
17 May, 1892.

WEDNESDAY, 18 MAY, 1892.

[The Commission met at 2 o'clock, in the Board-room, Colonial Secretary's Office.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

ALEXANDER BROWN, Esq., J.P.

6513. *Professor Warren.*] Previous to commencing the business of this sitting, I would like to make a statement with regard to the strength of certain bridges. A great number of bridges have been built recently, and since the sitting of the Royal Commission upon the bridges of the Colony in 1886, of which I was a member. I wish it to be understood that I cannot be expected, in this inquiry, to go into the measurements, stresses, and so on, of every bridge on our railway line. It would be absurd to imagine that I could devote so much time to those questions without prolonging the inquiry to a very great length. Therefore, unless a bridge is called into question, and becomes one of those matters into which we have to inquire, I shall not go into it. I have considered the Glen Lee Bridge, and I shall refer to that in the course of our report, but unless some particular bridge is called into question in a similar way I shall not go into matters concerning it, and I wish it to be distinctly understood here that I do not accept any responsibility with regard to any bridge that is not referred to in the course of our inquiry. There are plenty of these new bridges which I have not seen, and have no chance of seeing, perhaps, for some time.

6514. *Mr. Brown.*] Mr Eddy, I understand that you are practically in possession of the attention of the Commission at present, and I trust you are prepared to go on with your case. If you like we shall wait a few minutes until the full Commission is present, our President, Mr. Rogers, not having yet arrived, or if you prefer it we are prepared to go on now. Our Commission empowers any two of us to conduct the proceedings of this enquiry.

6515. *Mr. Eddy.*] I prefer, sir, to wait until the full Commission is present.

6516. *Mr. Brown.*] Very well, but we shall only wait a reasonable time, and should the President not then arrive we shall go on without him.

[The President entered the room a few minutes later.]

6517. *Mr. Eddy.*] Shall I make my statement simply, or do you wish me to make it upon oath.

6518. *President.*] I think, Mr. Eddy, it would be better to make it upon oath, since we asked Mr. Hoyle to make his statement in that way. You have already been sworn.

6519. *Mr. Eddy.*] I think I must trespass upon the time of this Commission somewhat, so as to explain the policy which has prompted the Railway Commissioners in this new departure in obtaining the Baldwin engines; otherwise, perhaps it will be scarcely intelligible to the Commission or to the country. The Railway Commissioners hold that amongst other objects in view by Parliament when the Railway Act was passed, and when they were appointed, was that of working the railways according to the most modern ideas, so that the greatest possible result would be obtained by the country, and it was never expected, they consider, that they should be tied down to working the railways on the principles that were in operation before they took office, as, if so, their appointment would be of no effect to the country. The New South Wales railways are most exceptional in their character, having been constructed with an enormous proportion of steep gradients, the worst grades being on the trunk lines, and so situated that the whole volume of traffic has to pass over them. The only way (now that the traffic is increasing so rapidly), to stave off a great amount of duplication work, is to introduce more powerful engines, and so, by taking much longer trains, at a better uniform speed, to enable the bulk of the single lines to carry satisfactorily for some time to come the traffic which could not otherwise be carried with the old class of motive power and system of short trains, without grave delays and inconveniences.

6520. When the duplication works in hand are completed we shall only have 150 miles of double line in existence, of which $8\frac{1}{2}$ miles are quadrupled, whereas, in the sister colony of Victoria, with its far easier grades, 297 miles of double line exist.

Mr. E. M. G.
Eddy.
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6521. The difficulties surrounding the working of the New South Wales Railways, having more than 2,000 miles of single line and exceptionally sharp curves, the steepest grades being also on the main lines within a short distance of Sydney, will be readily understood when I state that there are 629 miles of grades varying from 1 in 30 to 1 in 75, in the following proportions:—

Gradient.	As originally constructed.		Total.		As improved by deviations since 1883.		Total.	
	M.	Ch.	M.	Ch.	M.	Ch.	M.	Ch.
1 in 30 to 1 in 33	25	20	—	—	24	54	—	—
1 in 34 to 1 in 40	165	25	190	45	165	25	189	79
1 in 41 to 1 in 50	183	60	374	25	183	9	373	8
1 in 51 to 1 in 60	112	12	486	37	109	6	482	14
1 in 61 to 1 in 75	144	59	631	16	146	60	628	74
Totals.....	631	16			628	74		

I would also like to illustrate the difficulty of our working by a reference to the diagram [Appendix A], which shows clearly our maximum altitude and frequent loss of elevation in reaching that grade.

6522. The Western Line, for instance, is a more difficult line to work than any of the Alpine railways, the ruling grade, radius of curves, and frequent loss of elevation which has to be regained, being all against that line. The diagram and table (Appendix B 1 and B 2) which I place before you clearly demonstrates this. The Western Line attains an elevation of 3,248 feet, and has a maximum grade of 1-30, the length of incline being 29·5 miles. The Southern Line attains an elevation of 1,477 feet, has a maximum grade of 1-30, and the length of incline is 15·5 miles. The Northern Line attains an elevation of 2,105 feet, and has a maximum grade of 1-40, the length of incline being 30·0 miles. Now the Mont Cenis North attains a height of 2,637 feet, has a maximum grade of 1-33·3 feet, and a length of incline of 24·75 miles, and the Mont Cenis South attains an elevation of 2,793 feet, the maximum grade being 1-33·3 feet, and the length of incline 25·25 miles. The most difficult of the Alpine routes has a curve of from 14 to 15 chains, but on the Western Line of New South Wales we are burdened with frequent reverse curves of 8 chains.

6523. Professor Warren.] That is not a reverse curve?

6524. Mr. Eddy.] No; I take it they would not put that in; they are sure to have a transition between the two. The amount of traffic which has to be passed over the Blue Mountains on busy occasions will be seen from a diagram I have had prepared, showing the trains that passed over the single line with ruling gradients of 1 in 30 and 1 in 33, and the frequent 8-chain curves on that line, during a recent night, which came under my personal notice. [The witness here put in a diagram (Appendix C) showing the running of trains between Penrith and Eskbank and vice versa, between 5 p.m. on the 27th, and 8 a.m. on the 28th of April, 1892.]

6525. It will, I think, from this, be seen how difficult it is to work traffic which has to pass over in order to reach Sydney, a single line of 500 miles. It shows how necessary it is not to be bound down to antiquated ways where better may be obtained, and progress made in conformity with modern ideas.

6526. Several of these trains were heavy trains drawn by the powerful engines, and had these engines not been in use additional trains would have been required to have conveyed the traffic.

6527. As many as 196 waggons of live-stock in addition to the ordinary goods and passenger traffic have been moved in one day from the Western Line to Sydney (Homebush). This additional traffic in short, trains of fifteen waggons over a length of 500 miles of single line with grades ruling the load of 1 in 40, 1 in 30 and 33, for nearly 250 miles of the journey, is a great disturbing and difficult element to deal with and any improved method for working the traffic in fewer trains is much to be desired. The live-stock traffic is also growing very largely. All this heavy traffic had to be worked by short trains until these powerful engines were brought here. With reference to the live-stock traffic, I may add, that it has so largely increased, that if my memory serves me it has improved by something like 40 per cent. since we came into office.

6528. As pointed out when the Commissioners took office, there was such an infinite variety of types of locomotives that they decided in, the interests of economy and facility of repair, to adopt as few classes as possible, and with this in view, determined that the new passenger engine should be sufficiently powerful to work a paying load of live-stock or goods, and the engines placed upon the lines (Baldwin and English) effect this object.

6529. The failure of the various negotiations for the supply of engines to be built in the Colony and consequent great loss of time, the rapid increase of traffic, the worn-out condition of many of the locomotives, and the prospect of an exceptionally heavy wool season, rendered the immediate addition of new stock absolutely necessary. English locomotive builders being very busily engaged and consequently unable to supply our wants promptly, the Baldwin Works were applied to and offered to deliver a large number of most powerful locomotives within an unprecedentedly short period.

6530. While English locomotives are distinguished for the careful design of their details, excellent workmanship and general durability, American engines, while possibly inferior in these respects, undoubtedly possess great hauling-power and flexibility, and are consequently adapted for heavy gradients and sharp curves, and for road-beds which which are not so well constructed as those found in England. The Baldwin Company is the largest firm of locomotive builders in the world, having built over 12,000 engines, and their output in 1890 was 946 engines, about four times as many as any English maker. Their enormous output is a proof that their work gives satisfaction. In fact, in America the Baldwin Works enjoy a special reputation for the improved design of their engines which are to be found running on nearly all of the principal railroads of the United States. The Baldwin Works also export more locomotives than any other locomotive builders in the States, and their engines are to be found in all parts of the world.

6531. It may be interesting to state that the number of engines built by the Baldwin Company is equal to three-fourths of the whole of the locomotives on the railways of Great Britain.

6532. The actual performances of the two classes of Baldwin engines have been satisfactory, and the only defects have been in the axles, and small details, which have been put right at the cost of the makers.

The

The passenger and goods engines have already run over 450,000 miles, and the average failures are less than with other engines of somewhat similar type. We shall put evidence before the Commission to prove these facts. The returns which have been already supplied to the Commission show, I think, that the ordinary running repairs are very moderate when the heavy work the engines are doing is considered.

Mr. E. M. G.
Eddy.
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6533. Previously to giving the present order, the Government had very satisfactory proof of the class of work turned out by the Baldwin Company, that firm having supplied thirty-three locomotives for the New South Wales Railways, and ninety-one more for our tramways, it was, therefore, no new experiment or departure on our part to obtain supplies from that firm, and as one of the leading partners in the firm had some years ago spent a considerable time in the Colony, they were in an exceptional position to understand our requirements which were most urgent.

6534. Doubtless, the average amount of fuel burned per train mile, is less on English than on American lines, yet if the computation were per ton of train hauled per mile, it would be found that the consumption is less in America than it is on English lines, without taking into consideration the difference in the grades and curves.

6535. In my opinion there are many features in American locomotives which might, with advantage, be adopted by English engineers. With our heavy grades and curves, and growing traffic on single lines, a new departure in locomotive power was absolutely necessary, and the results which are beginning to be accomplished, clearly demonstrate the wisdom of the action of the Commissioners—the earnings per train mile for the quarter ending 31st March last, showing at the rate of 7s. 5½d., as against 6s. 6d. for the same quarter of 1890, this is upon a total mileage of over 2,000,000 of miles in the quarter. That alone will carry conviction to anyone who thinks of railway management. The amount of assisting engine miles (*i.e.*, a second engine with trains) is also being largely reduced. In fact, I may mention that our mileage for last month has shown a reduction of about a million three-quarters miles per annum, which will be further decreased when we get the remainder of the more powerful engines now under order.

6536. I think it will be desirable for me to distinctly describe the weight, &c., of the Baldwin engine and tender. The total weight of the engine when empty is about 51 tons 5 cwt. 1 qr., when loaded to its fullest extent, with water in the boilers, &c., it weighs about 58 tons 7 cwt. This weight is distributed over ten wheels, four belonging to the bogie in front of the engine, and the other six are coupled driving wheels, the middle pair being without flange, so as to reduce the strain on the permanent-way in going round curves.

6537. The average weight on the three driving-axes is 14½ tons, but a weight of about 15 tons 6 cwt. is placed on the middle or flangeless pair of wheels, therefore a weight of about 7 tons 13 cwt. is the greatest weight on any one wheel in the engine when it is fully loaded. This is because there is really no strain upon the permanent-way except the bearing stress. The tender, which is mounted on two sets of four-wheeled bogies, weighs when empty 13 tons 12 cwt., and when loaded with its maximum quantity of coal and water about 32 tons. It will therefore be seen that the engine, as arranged, is exceedingly flexible, and far less destructive to the permanent-way, with so many curves of 8, 10, and 12 chains radius, as we have on our main lines, than engines which have been running here for years past. I now propose to submit to you a set of small diagrams of engines. [*The witness here put in diagrams of engines "class J" and "class O." Appendix D 1 and D 2.*]

6538. I would also like to show the Commission a photograph of an English engine. [*Photograph produced.*] From this you will see that there is a great difference between the stress on the permanent-way of the English and American engines. The whole of the frame of the English engine is rigid, and when going at full speed the engine necessarily pulls the road about. The American engine has, on the contrary, the leading four wheels flexible, and they play easily when going round the curves; also the middle pair of wheels is without flanges, and tread the rail without any lateral pressure upon it. The English engine shown in the photograph carries about 15 tons on the driving wheel, and would knock our road about dreadfully. [*Witness here pointed out on the diagrams the relative weight upon the wheels of locomotives.*]

6539. These engines (American) are now daily working trains which formerly required two engines to draw them, and are also doing the work in a much more satisfactory manner.

6540. Two engines were employed in working the western mail from Penrith to Wallerawang or Bathurst four out of every six nights in the week, and on the remaining nights as far as Katoomba. An assistant engine had also to be kept in readiness at Bathurst to assist the train if necessary as far as Dubbo, the throughout distance, Penrith to Dubbo, being 244 miles. The day train Sydney to Orange also had to be assisted three days out of four between Penrith and Katoomba. By the introduction of the Baldwin engines, one engine (excluding a few very exceptional cases) has a reserve power for dealing with ordinary traffic without entailing the necessity for attaching an additional engine. The 5.50 p.m. train by which regular passengers return from Sydney to the Mountains has been accelerated since the Baldwin engines have been put to work it by 15 minutes between Penrith and Wentworth Falls, and is now running punctually, whereas formerly, even when assisted by a second engine and with 15 minutes additional time, it was almost always late.

6541. The Saturday afternoon special train Sydney to the Mountains has also been accelerated in a similar manner, and is now worked by one engine, with the same result as regards time-keeping and assistance. That may appear a small matter, but it is telling upon our traffic in a most effectual way. The use of these engines is increasing the traffic to the Mountains, through the superior facilities we are enabled to offer to tourists. It has already increased very largely, and we hope, by getting these more powerful engines, to induce most of the people in Sydney, who can afford such a luxury to live as much as possible in the Mountains during the oppressive heat of the summer months.

6542. It should be self-evident that the one engine weighing with its tender, when fully loaded, about 90 tons will do less harm to the permanent-way than two coupled together, weighing in the aggregate 128 tons.

6543. There is, however, another and most important point gained, *viz.*:—the greater safety secured by having the train controlled by one engine, and set of men, instead of two acting independently of each other. The more powerful engine is also able to maintain a better speed up the inclines, so avoiding the excessive speed in going down inclines, which is an element of risk, and is most destructive to the permanent-way.

6544. Since I wrote these words we have had a most melancholy illustration of the great advantage gained through adopting that course, and I shall read to you an extract from a report of a special board in which two gentlemen outside the Service were associated with our engineer to report upon the Tarana accident; from that report it will be seen that it is quite clear that a very considerable number of lives were

Mr. E. M. G. Eddy. were saved by the Baldwin engine being attached to that train upon that night, instead as otherwise might have been the case with two coupled engines.

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"From the exceptional amount brake-power on the train, and especially on the type of engine which was attached when the accident occurred, this power—so promptly applied by the driver—probably saved the train from being totally wrecked, and certainly minimised the loss of life. The weight of this train was such that it would have required two engines of the type previously used for this traffic to do the work, in which case the brake-power would have been materially decreased, while the unbraked weight would have been largely increased, consequently the train would have travelled much farther before it could be stopped. We deem it of great importance to point out that the whole of the brake-power and its application was under the control of one man; whereas, in the case of two engines, concerted action in the instantaneous application of the brakes is practically impossible, and the leading engine-driver would, in all probability, be entirely ignorant that anything had happened; consequently, the hauling power of that engine would be working against the brake-power of the train. The fact that this brake was powerful enough to bring such a heavy train to rest on a falling grade in less than 100 yards we consider a most important advantage, the value of which cannot be over-estimated."

That train was travelling on a falling grade of 1 in 50. On the Southern line in working the Melbourne express, the same system of working with two engines was in operation, as existed on the Western Line, the two engines with their tenders weighing 128 tons, whereas a single English 10-wheeled engine weighing about 88 tons, works the train with ease. [*Diagram of engine Class "P" put in. Appendix E.*]

6545. I think we have put before you already a diagram of that engine. You will find the figures in connection with that engine different from those which were previously placed before you. The reason for that is this. The paper has only recently come before me. I had asked for it to be prepared, but it was only placed before me a few days before the Commission sat.

6546. *Mr. Brown.*] Are you referring to the new English engine?

6547. *Mr. Eddy.*] Yes.

6548. *Mr. Brown.*] We have so far shut out evidence with regard to the English engine.

6549. *Mr. Eddy.*] Yes; but you now have the diagram before you, and the figures are quite different from any you have had.

6550. *Mr. Brown.*] Quite so, only we did shut it out, and therefore we thought it better in justice to the other side that you should not refer to it.

6551. *Professor Warren.*] Mr. Eddy, I understand is correcting the notes we have before us. We have gone a certain distance with this matter, and perhaps it would be better now to put it right.

6552. *Mr. Eddy.*] The figures given to you were altogether different from what had been pointed out to me at Beyer and Peacock's works when I was in England, and that was the reason I asked for the papers to be produced. Same papers, it transpired, were stolen from the Chief Engineer's Office, and as the figures were in the possession of someone outside the department, we thought it right to put forward an accurate copy. There is a grave difference between the figures which have been pointed out to you and these I now put in. At the time I challenged the figures, and asked for the original papers to be put in, in order to see how they differed. These figures are accurate. Mr. Thow has personally had charge of the weighing, and knows that these weights are as accurate as our scales can make them. The weight of the southern express and mail without engine and tender varies from 130 to 192 tons, and may be taken at an average of 156 tons.

Weight to pass over line:—

Train	...	...	156 tons	...	...	...	156 tons.
Two engines	...	...	128	,,	10-wheeled engine	...	88 ,,
Total	...	...	284	,,	Total	...	244 ,,

making a saving in weight to be hauled of 40 tons, and also relieving the permanent-way of the same amount of wear and tear.

6553. In working the southern express and mail trains between Sydney and Junee nine of the new engines will displace seventeen of the lighter machines.

Capital Outlay:—

17 old 4-wheeled coupled, at £2,870	...	...	...	£48,790
9 at £3,700	...	...	...	33,300
Reduced capital	...	...	...	£15,490

Mileage per annum of the two services, with assisting mileage:—

Under old system	...	...	563,760 per annum.
Under new system	...	...	345,000 ,,
Saving per annum	...	...	219,000 miles.

6554. The average cost of each engine mile for the whole line amounts to 12.35d. Therefore, if the saving of running one of the engines is placed at the low estimate of three-fourths of the average cost, viz.:—a saving of 9d. per mile in connection with the mileage saved, there will be an annual saving of £8,212, or £912 per annum each engine.

6555. The interest on capital outlay for the nine engines at 4 per cent. is £1,332 per annum, or £148 per engine. The investment in each new engine after paying interest on the same means a net saving of at least £764 per annum, and all the advantages described are also gained.

6556. There would be a good many companies who would be willing to thoroughly equip the New South Wales railways, and pay the Government half the profits they received from our lines.

6557. With regard to the American goods engines, from very carefully-prepared returns made by the Outdoor Superintendent and the Chief Traffic Manager, it would appear that during the months of February and March fifteen of these engines on the Western line saved 27,000 train miles, as against working the traffic in absolute full train-loads by the most powerful of our ordinary goods engines. I may explain that the difference between train miles and engine miles is thus:—Every mile an engine runs, for shunting, or assisting, or ballasting, or any purpose of that kind, is dealt with as an "engine mile." But we only put under the head of train miles the miles run by engines on trains which are either actually working the goods traffic or passenger traffic on the advertised service.

6558. These are two light months of the year and it is estimated that on the whole year's working a saving of about 222 000 miles will be effected. That is with the Consolidation goods engine. Another great advantage gained is the reduction in risk of accident and the fewer delays that will be experienced in passing the traffic along the single lines, and through the trains passing each other on the journey. To illustrate this, it may be mentioned that in February, between Penrith and Dubbo, 15,219 waggons were moved by 551 trains worked by the American engines, whereas it would have required 796 trains worked by the ordinary engines to have moved this number of waggons. It may also be pointed out that, looking at the great power developed by these engines, the price paid for them is an exceedingly moderate one—indeed, it has not been suggested in the course of this inquiry that the expenditure incurred in their purchase has been in any way excessive or extravagant.

6559. I will now deal with the charges *seriatim*.

6560. The first charge is:—"That, in consequence of the extra width of the Baldwin engines or their great length, the platforms on various parts of our lines have had to be altered."

6561. This is entirely inaccurate. The facts of the case are that either various platforms had been erected since the lines were opened without proper attention having been paid to building them to the gauge laid down by the late Engineer-in-Chief—Mr. Whitton, or, in maintaining the roads, the rails had been moved towards the structures. The grave inconvenience and danger arising from this state of things was brought forward prominently years before the Commissioners took office, but the subject was not effectually dealt with until the present Board took over the control. The question, however, was dealt with and decided upon before the Baldwin engines were ordered.

6562. Had the works been kept to the gauge laid down by Mr. Whitton, not one penny would have been required to be spent to admit of the running of the engines. The diagram I now place before the Commission of the standard gauge for works and maximum size of rolling-stock in existence before the Baldwin engines were imported shows this clearly. [*Diagrams put in.*] The engines as ordered were within the extreme measurements of engines, &c., already upon the lines, but which had been restricted by the late administration to certain parts of the lines, because of the known defects in gauge. The total cost of making the necessary alterations to admit of the locomotives and rolling-stock of the maximum size passing over all the main lines has only amounted to about £3,200—a very small sum, when looking at the great advantages gained by its expenditure, and whether the Baldwin engines were imported or not the correction of the gauge was a matter of urgent necessity. Diagram of the profile of the Baldwin engines in connection with the existing structures throughout the whole system is submitted, also diagrams of stock provided by the late administration. [*Appendix F 1 and F 2.*]

6563. The witness then described upon a large diagram the relative dimensions of the double tunnel, single tunnel, over-bridge, passenger roofs, goods-shed roofs, and goods and passenger platforms with regard to the height and width of the Baldwin engines.

6564. The Baldwin engines were ordered to have 9 ft. 3 in. over their cylinders, but as a matter of fact they varied somewhat in width. We had a number of them measured when they were first put together, and they varied in all from 9 ft. 3½ in. to 9 ft. 4½ in., but that is the extreme width of the Baldwin engine over its cylinders, and there is therefore a clearance of 3½ in. if the rails had been kept to the proper distance from the platform according to the standard gauge. A diagram of class 132 engine was put in. [*Appendix G.*] It was mentioned that this engine is equally as wide, if not wider, than the Baldwin as specified for, being 9 ft. 3½ in. over the cylinders, and on account of the known defects in the fixed structures on a portion of the line, had been limited in working to certain sections.

6565. With regard to the charge,—“That the safety of the draw-gear will be in danger if the Baldwin passenger engines or the Baldwin consolidation goods engines draw the loads that is stated by the railway authorities they are intended to draw,”—

It has already been shown in evidence that the draw-gear in the engines is lighter than ordered in consequence of an error in the Baldwin works, and the draw-gear was at once changed at the expense of the Baldwin firm.

6566. It has also been shown that the draw-gear on the rolling stock is sufficiently strong for all purposes of safety, and that its strength was specially considered prior to the ordering of the engines in question. The recent unfortunate accident at Tarana also established the strength of the draw-gear as it did not break although subjected to the strain of vehicles being off the line. I may mention that two engines together were previously running both on the goods and passenger trains, and we have only taken off these two and put on one more powerful locomotive. The actual weight of the train behind the engine has not been increased.

6567. With regard to the charge,—“That there are engines already in use on our railway system that are as powerful as the Baldwin passenger engines, and, therefore, another type of engine has been added to our stock, thus increasing the already too many types of engines in existence.”

6568. *Mr. Hoyle.*] I think the charge you are reading now was disallowed, Mr. Eddy.

6569. *Mr. Eddy.*] I do not understand that to be so.

6570. *President.*] What we disallowed was a question as to whether it was wise of the Commission to order these engines, because that involved the ordinary railway policy, which we held was a matter you could not go into. If you refer to the earlier part of the evidence the matter will soon be settled.

6571. *Mr. Brown.*] I think it was disallowed. But look at the evidence, and you will soon see.

6572. *President.*] I think it was disallowed because it went into the question of the right of the Government to order these engines.

6573. *Mr. Hoyle.*] If it would help the Railway Commissioners in their management I would rather consider it to be allowed. But certainly, throughout the conduct of my case, I took it that this charge had been disallowed by the Commission.

6574. *Mr. Eddy.*] What has been done in this matter has been done with no desire to help the management of the Railway Commissioners, but only to obstruct it.

6575. *President.*] The second charge was disallowed,—“That the Baldwin passenger-engines are not required, and should not have been imported, as orders had already been sent out of the Colony for sufficient engines to meet all the requirements of the Railway Department; that the money thus spent was, therefore, an unnecessary expenditure of public funds.” The fourth charge was,—“That there are engines already in use in our railway system that are as powerful as the Baldwin passenger-engines, and therefore, another type of engine has been added to our stock, thus increasing the already too many types of engines in existence.” [*The evidence was here produced and referred to.*]

6576. Upon referring to the evidence I see that you are right—a majority of the Commission decided that it should be gone into.

Mr. E. M. G.
Eddy.

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Mr. E. M. G. 6577. *Mr. Brown.*] You will find it at question 35, as follows.—
Eddy.

6578. *Mr. Hoyle.*] My fourth charge, Mr. President, is,—
“(4) That there are engines already in use in our railway system that are as powerful as the Baldwin passenger engines, and, therefore, another type of engine has been added to our stock, thus increasing the already too many types of engines in existence.”

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6579. *Mr. Eddy.*] I must again object. The charge (No. 3) opens up the whole question of railway management.

6580. *President.*] It has been decided, and I cannot hear you any more. It has been decided by a majority of the Commission to admit the charge (3).

6581. There was not in use on our railways a passenger engine as powerful as the Baldwin, and no one in the service could confirm the assertion made. With regard to the types of engines, as the restriction of type was one of the first things the Railway Commissioners on taking office announced their intention of dealing with, they can be safely left to carry out their own intentions. They, however, do not propose to put the Locomotive Department right by adopting as standard types engines they do not approve of, and so continue the wasteful expenditure caused by having so many types.

6582. *President.*] Mr. Hoyle calls my attention to another part of the evidence showing that this charge was disallowed. The following is the passage in the evidence referred to:—

38. *Mr. Hoyle.*] (Repeated the fourth charge.) It has been said, in inspired paragraphs in the Press, that we had no engines here powerful enough to do anything like what these engines can do. I say that we have engines quite powerful enough for that purpose.

39. *President.*] That is entirely outside the scope of this inquiry;—I understand you to say that the Commissioners have ordered something that is clearly unnecessary;—the question is whether they have received what they have ordered or not; whether these engines were necessary or not does not matter;—that can be no charge.

But, as you have got so far in your remarks, perhaps it does not matter.

6583. *Mr. Hoyle.*] I have no objection.

6584. *President.*] As a matter of fact, by having sold some of the exceptional types, broken up a few that were completely worn out, and having placed others on the duplicate list, to be worn out in performing ballasting and other unimportant work, the twenty-eight recognised types have been already reduced to eighteen, even if all the new American and English engines are included, and out of the total stock existing at present, of 481 engines standing on the books on capital account, 331 of them belong to four types.

6585. We often hear of forty-two different types, but, as a matter of fact, there are only twenty-eight actual distinct classes or types of engines in the service of the New South Wales Railway, and we have already reduced that twenty-eight to eighteen by taking the course I have indicated. That includes all the new English and American engines. I might explain, with regard to purchase of engines, that it is customary with all good undertakings to renew engines out of working expenses, and somewhat in advance of time, because there is always depreciation going on in connection with all rolling stock; so that, unless you pass something then to what stands on your books, you will afterwards be on the wrong side of the ledger. All good companies renew their engines sometimes in advance of time, and place them on their books. The engines so replaced are allowed to work themselves out in such work as ballasting and shunting, and work of that kind, and here we are adopting the same principle. We have a number of engines, waggons, and carriages which the capital account is free of altogether.

6586. With regard to the charge,—

“That the Baldwin passenger engines and the Baldwin consolidation engines are faulty in design, and that certain parts—the axles of the bogies and tenders—were dangerous, and grave neglect was shown by allowing the engines to run before the parts in question were removed.”

6587. I submit that not one iota of evidence of any weight has been produced to prove that the engines are faulty in design; on the contrary, the witnesses called to testify against the engines have nearly all admitted that they are well-designed, and are performing the work expected of them. When the charges were promulgated in Parliament not a defect had shown itself in any of the engines, in fact, only a portion of the passenger engines were in steam, and not one of the goods engines had arrived in the Colony, the first one being put in steam on the 30th of September, whereas the charges were made on the 20th August. Although the attack was made in Parliament on the 20th August, the first failure that occurred was on 27th October—more than two months afterwards.

6588. With new engines small matters like axle-boxes running hot, and points of that kind, cannot be looked upon as failures, as all new machinery, whether in steamships, workshops, or locomotive engines, requires careful attention for a time. With regard to the failure of the bogie axles, &c., the Commission has had placed before it a letter from the Baldwin firm, which reads as follows:—

Baldwin Locomotive Works, Burnham, Williams, & Co., Philadelphia, 15th February, 1892.

Mr. H. McLachlan, Secretary Government Railways of New South Wales, Sydney, N.S.W.,—

Dear Sir,

Your two favours of 27th November and 7th December were duly received, but our reply has been unavoidably delayed. It is with the utmost regret that we have learned of the breakages of the engine and tender axles of the twelve 10-wheel passenger locomotives which were received last year, per “Henley.” The several reports sent us have received careful consideration. In contracting for these locomotives, the Commissioners desired to obtain engines adapted to unusually heavy service. In order to secure the utmost efficiency, and to obtain the best results of American experience, they left many of the details of the specification to our judgment. The material for the driving-truck and tender-axles was left optional, and as, in our opinion, the most satisfactory results are usually obtained from axles carefully forged from selected scrap-iron, we ordered such axles from the manufacturer, whose product we had been largely using with good results, and whose reputation for excellent work is generally recognised. No test was prescribed by us, as it is well known that no test of scrap-axles is conclusive. We relied upon their showing clean, uniform, well-worked material when turned up in the lathe. Steel axles, or axles forged from muck-bars, can be tested under a drop with reasonable probability of the uniformity of the axles not tested, but the fact that a hammered scrap-axle withstands such test is no guarantee that others of similar manufacture and appearance will stand. Not only have we been buying axles in this way for many years but, so far as we know, it is the general practice in buying hammered scrap-axles, both by railroads and manufacturers. These axle forgings did turn up clean, smooth, and free from flaws, and we supposed to be as good as the many hundreds which we have received from the same maker without one instance of failure coming to our knowledge. We go into the matter at this length to assure you that there was no conscious lack of diligence exercised by us to supply materials of the best quality, which your Government was entitled to receive from us.

We have already replaced the twenty-four engine truck-axles with others of steel. We offer to reimburse the Government the cost of replacing the forty-eight tender-axles. We also offer to pay the reasonable cost of the labour involved in effecting the replacement.

6589. *Witness.*] They have also paid for a number of other things, the cost of which we thought they ought to bear. Mr. E. M. G. Eddy.

We are of opinion that the original dimensions of the truck and tender axles and journal bearings are ample for the fast speed for which the locomotives are suitable, provided the quality of the material is good, and the bearings for such engines have been widely adopted for similar service with good results. We should have much hesitation in increasing the diameter of the bearings with such small wheels, owing to the higher rotative friction. It should be borne in mind that the smaller truck-wheels necessary in engines of this type require closer attention to the lubrication than the larger wheels, usual in English locomotives. 18 May, 1892.

If, however, large bearings are adopted, we urge the desirability of making them $5\frac{1}{2}$ inches rather than 6 inches diameter. In view of the above, we think the cost of new boxes—whether of iron or solid gun-metal—should not be charged to us, as we are certain that the replacing of the axles will prove a sufficient remedy.

We remark that the driving-axles were not made by the same party as the truck and tender axles. We, therefore, trust they will, upon investigation, prove satisfactory.

There appears to have been a clerical error in transmitting to our shopmen the dimensions of drawing-hook shown by your drawings.

We authorise you to debit to our account the cost of replacing them with stronger hooks.

With these modifications we trust the engines will speedily show the special adaption (which we believe they possess) to the difficult service for which they were ordered. That similar engines are doing such work on our American railways is shown by the recent test of our 10-wheeled locomotive on the Baltimore and Ohio Railroad. Under separate cover we mail you three copies of the report of these tests. We trust these tests will in a measure justify the wisdom of the Commissioners in the purchase of these locomotives, and that after the defective axles are replaced the performance of the locomotives will be such as to merit their entire approval.

Yours, &c.,

BURNHAM, WILLIAMS, & CO.

6590. All the cost of failures due to faulty workmanship has already, and without demur, been paid by the Baldwin Company, and we still hold a considerable sum of money belonging to the Company in case any other weakness should develop.

6591. We deem it only right to say that we feel sure the Baldwin Company did not knowingly allow any defective material to be placed in the engines, and also acknowledge the readiness with which they and their representatives in Sydney did all in their power to rectify defects. Almost without a challenge they agreed to anything we proposed.

6592. With regard to the latter part of the charges it has been shown in evidence, even by witnesses called in to support the charges, that the usual precautions were taken in regard to inspection before the engines were put in work, and that no ordinary and usual mode of inspection could have detected the weaknesses which later on developed themselves. I think I may at this moment put in the result of some experiments with the Baldwin engines that we made some few weeks ago to test their hauling power. We had not before tested these engines as to what they really could do. We had not driven them up to the highest point of their capacity. We simply put them to their work, and they were only called upon to the extent of the reasonable requirements of our traffic. When first using an engine it is not usual to test it to the utmost of its power—it is allowed to work up to its maximum capacity gradually. But when this inquiry commenced we thought it desirable to see what they really could do, and we gave directions that both a passenger and goods engine should be tested, and they were tested upon the Western line, and hauled exceedingly heavy loads. The passenger engine was put to draw goods waggons, which is a heavier test than drawing passenger carriages. On the 1 in 33 grade the engine hauled 168 tons at the rate of $14\frac{1}{2}$ miles an hour. On the 1 in 40 grade the engine did not do so well as we had anticipated, till ultimately we found there was a piece of grade there of 1 in 37. The passenger engine went up this bank at $12\frac{1}{2}$ miles an hour, with 195 tons. On the 1 in 50 grade the engine hauled 254 tons at $14\cdot3$ miles per hour. The Consolidation goods engine, up the 1 in 33 grade, took 274 tons at $7\frac{1}{2}$ miles an hour, and on the 1 in 40, part of which is 1 in 37, the engine hauled 341 tons at $4\cdot7$ miles per hour. On the 1 in 50 grade the engine hauled 433 tons at $9\cdot7$ miles per hour. These are very excellent results, and we question whether better have been ever obtained.

6593. *Professor Warren.*] I think we got better results on Sunday.

6594. *Mr. Eddy.*] Well, you had passenger stock then. These results were with goods engines. I will now put in this report. [*The witness here put in "a Joint Report by Messrs. H. Richardson, C. H. Stangar, and D. H. Neale, relating to tests of the New American Engine," together with a section showing the grades on the Marangaroo Bank.*] Another report, or, rather, I should say, interim report, was put into my hand as I entered the room by Mr. Hector Kidd and Mr. Robert Pollock, who took the indicator diagrams on Sunday last during the trial trip. I will read what these gentlemen say:—

INTERIM REPORT.

To the Commissioners of Railways, New South Wales.

Gentlemen,—In compliance with your request we have made a careful series of experiments with a 10-wheeled American engine, No. 447, in order to ascertain accurately the performance of the engine when hauling passenger engines up grades of 1-30 and 1-40.

In your letter to the Baldwin Works, 22nd September, 1890, you stated that you wished the engines to haul regularly a load of 120 tons, exclusive of engine and tender, up a gradient of 1-30 without sharp curvature, and that occasionally you expected that a load of 144 tons should be taken up. On a gradient of 1-40 you stated that the regular load of 152 tons should be taken at about 22 miles per hour, and that the engine should be capable of occasionally taking a load of 176 tons. Our tests were especially directed to ascertain if the engines were capable of performing the above work. The trains were made up of Pullman sleeping-cars and first-class lavatory carriages, and in all cases weighed somewhat more than the stipulated loads.

We succeeded in taking no less than 44 indicator diagrams, which will enable us in a few days to present you with a complete report as to the indicated horse-power of the engine, with a tractive-power and the resistance of the train.

Meanwhile the data so far obtained enable us to say that the load hauled and speeds obtained were as follows:—

No. of trip.	Gradient.	Mean speed on the whole length of gradient.	Weight of train exclusive of engine and tender.	Remarks.
		Miles per hour.	Tons. Cwt.	
1	1-40	18.50	179 5	Length of gradient $2\frac{1}{2}$ miles.
2	1-40	20.15	157 12	Several curves of 16 chains radius on first mile.
5	1-40	21.09	157 12	About 2 miles of 1-30 and $\frac{3}{4}$ mile of 1-33. Curvature moderate.
3	1-30	18.87	121 14	
4	1-30	15.17	144 2	

Mr. E. M. G.
Eddy.

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We regard the results as extremely satisfactory and have little doubt that had the driver run such a train regularly, he would have been able to obtain even better results from the engine on the 1-40 gradients, which occurring immediately after he left Picton with a somewhat dead fire prevented the engine steaming as freely as she did in the 1-30 grades. The latter however were approached by several miles of easy rising gradients in running over which the action of the blast thoroughly ignited the fire, and consequently enabled the engine to steam freely and maintain its speed on the grade.

We have, &c.,

HECTOR KIDD,
ROB. POLLOCK.

Well, gentlemen, I think these performances are really magnificent performances.

6595. *Professor Warren.*] Undoubtedly.

6596. *Mr. Eddy.*] In running the traffic from London to Scotland I can assure you of enormous talk of—and—but there we were only dealing with gradients of 1-75, while here we are dealing with 1-3.

6597. *Professor Warren.*] I shall have to ask you one or two questions about the speed when you have finished your evidence.

6598. *Mr. Brown* (to *Mr. Eddy*).] Really, that ought not to form a part of your case at present. You should call the witnesses who can prove these facts, and I presume you will submit them for examination afterwards.

6599. *Mr. Eddy.*] I am simply making a statement on behalf of the Commissioners, and I shall call witnesses to prove all the documents that I have read.

6600. With regard to the charge, "That in consequence of the great weight of these engines (the Baldwin passenger and consolidation), the safety of the permanent-way is likely to be endangered, our standard rail being 71 lb. per yard, whereas the above-mentioned engines were designed for an 80-lb. rail," I beg to state that the whole charge is erroneous. The standard rail for the New South Wales Railways is 80 lb. to the yard steel rail, and at the present time no less than 200 miles exist, and the sleepers are laid 2 ft. 7 in. centre to centre, each sleeper averaging in weight over 2 cwt. 1 qr. The lightest rails these engines work are 71-lb. steel rails, but much of the road is 75-lb. iron and steel and 80-lb. steel. The question of the weight of the rail, however, is rather one of economy than of security, as the 71-lb. steel rail is sufficiently strong to carry an engine with a greater weight upon an axle than is the case with the engines under review. So far as the ordinary permanent-way is concerned, the actual weight of the engine is of far less importance than that of the distribution of the weight upon the wheels. In the case of the engines under consideration, the 58 tons which the engine weighs when fully loaded is distributed over five pairs of wheels and axles, and the weight upon any one axle and pair of wheels is less by 1 ton 2 cwt. than in the case of engines which have been running for years past, and at a time when the roads were not in so satisfactory a condition as they are to-day.

6601. I have had prepared, with a great amount of care, a statement showing the weight of rail in use in other parts of the world and the weight of engines run upon those rails, together with particulars of the weights borne by some of the driving-wheels, and this table will give a large amount of valuable and reliable evidence on the subject. (Appendix H). That table will show you that in America on iron rails weighing 56 lb. to 60 lb. per yard, and on steel from 62 lb. to 70 lb. per yard, an engine is running with 19 tons 14 cwt. on its driving-wheels, and is going at a speed of from 70 to 90 miles an hour very frequently. You have got references here for that statement, and I am prepared to put in, if necessary the whole of the documents, of which Poors' manual is the most important. [*A volume of Poors' Manual put in as evidence.*] The Baltimore and Ohio Company have an iron rail of from 60 lb. to 80 lb. weight per yard, and their steel rail is 67 lb. per yard. That is lighter than any steel rail than we have in this Colony. They are running engines with 15 tons 14 cwt. on their driving-wheels, and the total weight of the engine and tender they are running is 93 tons 6 cwt. On the New York Central Railroad their maximum weight on the driving-wheels is 17 tons 16 cwt. Their steel rails are from 65 lb. to 80 lb. per yard in weight, and on those rails they run regularly the Empire State express, which is the fastest train in the world; and on the Philadelphia and Reading Railroad, where the maximum weight on one axle amounts to 17 tons, they use steel rails, varying from 56 lb. to 90 lb. weight per yard. The London North-Western Railway Company, with which I was nearly associated for a quarter of a century, keep the weight down very much. Here we look upon 1-30 as rather a troublesome grade, but but their worst grade is 1-75, and their object is not to run an engine adapted especially for that grade, but to employ a class of engines that will be useful for the average work of the road. The maximum driving weight on their engines is 15 tons 10 cwt., but those engines are not ballasted in the beautiful way in which the American engines are ballasted. The weight of the steel rails on the London and North-Western vary from 80 to 94 lb. per yard. Then the North-Eastern Railway Company, which is the great competitor. London and North-Western run engines with 17 tons 15 cwt. on their driving-wheel. I am not certain of the weight of the rails on that line, but we will query it at 90 lb. per yard. The Great Northern Railway Company has engines with 17 tons on their driving wheels, and steel rails of 82 lb. per yard. That company runs exceedingly fast trains—indeed, it is the great racing line of England. Our 10-wheeled Baldwin engines carry 15 tons 5½ cwt. on a flangeless pair of driving wheels. The average weight on our driving-wheels is 14 tons 10 cwt. Our lightest rail is 71 lb., and it is a steel rail. We have also steel rails weighing 75 lb. and 80 lb. per yard, whilst the iron on the Western Line is 75 lb. to the yard. We have, therefore, a greater weight of road to run upon than many of the lines to which I have referred, and I will show you presently how our road is far superior to any other roads in the world. The Eastern Railway Company of France employs engines carrying a load of 16 tons 2 cwt. on the driving wheels; there steel rails run from 69 to 89½ lb. to the yard.

6602. Referring to the French railways, the *Engineer* of 4th March says: "It might be thought that the engines would be somewhat heavy for the road, but the Chief Engineer of the permanent-way reports that 10 per cent. additional weight on the wheels is quite within its power to sustain. The rails are of steel, 69 lb. to the yard, but of later years, on different harder-worked sections, other of 89½ lb. to the yard, had been laid. These are 39 feet long, and cover sixteen sleepers. The rail is spiked direct to the sleeper in machine-sawn notches, that give a uniform inward cant to the rails. Under the flange, and on the sleeper, are laid pieces of felt soaked in tar to give a softer bedding, and prevent vibration."

6603. So you see this French engineers says that the rails 69 lb. to the yard can carry 10 per cent. to the yard more than 16 tons 2 cwt on a pair of drivers. I thought it was so striking that I ought to bring it before you. It is, of course, difficult to produce facts at this distance from England and America, to disprove statements made without justification, but fortunately I am in possession of some valuable information on this particular subject. I deal with this matter very elaborately because I think it is a most

serious

serious one that has been brought under the notice of the Commission, and it is one that is likely to alarm the public to some extent unless it is once for all disposed of. It was stated at the opening of this inquiry, in support of this charge, that the rail in use on the Baltimore and Ohio line was a steel one, weighing 80 lb. to the yard. This was stated to be on the authority of Poor's Manual, and the Railway Gazette. Poor's Manual states that the rails in use are iron 60 to 80 lb. per yard, and steel 67 lb. per yard. I submit to the judgment of the Commissioners the fairness of such a distortion of what is given in Poor's Manual. In addition to this I append copies of cables that were sent in August last, to and from America, when the statement was first made in Parliament (as it was so contrary to what was understood by the Railway Commissioners), from which it will be seen that 67 lb. steel is the new standard rail. Our steel rails are 71 lb., 75 lb., and 80 lb. to the yard. This is the copy of the cable sent by Messrs. R. Towns & Co. to Messrs. R. W. Cameron & Co., New York, on the 24th August, 1891.

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"Telegraph immediately for Government how many six-wheel coupled passengers, and eight-wheel consolidation goods, the same as "Henley," "Strathdon" (the names of the ships that brought our engines out) are running America. Is result satisfactory generally. Consult Forney. Advise weight rail Baltimore."

The following is a copy of the reply that was received to that cablegram:—"Eight-wheel goods in general use with favourable results, weight better distributed and less destructive to rails. Coupled six-wheel passenger, same result as to rails. Over four wheels with increasing demand for heavy trains especially on western roads, but not used on Pennsylvania or New York central. They prefer dividing train. Baltimore steel rails 67 lb. per yard."

Those two lines named have fairly easy grades as compared to our grades.

6604. The Commission has had evidence placed before it in support of the charge as to the importance of the society in America, styled the Master Mechanics Locomotive Superintendents Association. The body is undoubtedly a most important one, and much good has come out of its deliberations. It is well, therefore, to know what that body has decided upon this important question. At the annual convention of the association, in June, 1891, a committee of the society reported that the limit of weight per driving axle should be 33,000 lb. (14½ English tons) for rails under 60 lb., and 36,000 lb. (16 tons 1 cwt.) for rails above that weight. My authority for making that statement is the official report of the proceedings of the association at its annual convention in 1891. So that on a 62-lb. rail they consider that you can run with safety an engine over 16 tons 1 cwt. on the driving wheels.

6605. Wellington's work "Railway Location" is one of the standard works on railways, and from the extracts given below it will be seen that in America 70 lb. per yard for steel rails was evidently the highest standard, but that, for reasons of economy, an 80-lb. rail was urged, and it was thought it would doubtless be adopted ultimately. "Light rails," he says "are sooner or later avoided as the plague by all railways." He states (Tables 195, 196, and 197, page 740) that, by substituting an 80-lb. rail for a rail of similar form but 70 lb. weight the gain in the three essential qualities of the rail is as follows:—Stiffness 30 per cent., strength 22 per cent., durability 43 per cent. As the increase in first cost is barely 14 per cent. the advantage is obvious. Then again on page 747, and table 198 he states that, even supposing a 70-lb. rail has a life of sixty years, it is more economical to buy 75-lb. rails, reckoning compound interest at 5 per cent.

6606. On page 748 he says, again, "of all directions for economy, cutting down the rail section is the most costly in the end." On page 761 he says "It is in every way probable that in a few years 80-lb. or 90-lb. rails will be the rule, and lighter rails the exception. The inertia from past precedents which have come down to us from the days when rails were several times more costly than now, will in time be overcome." Then again he says "We have reason enough, and to spare, why all roads should tend as they do tend to use a heavy rail." It is all a question of economy why all roads should use a heavy rail.

6607. I will illustrate that by two sections of rails we have here. The 71-lb. rail was the standard rail when we took office. The head weighed 32·64 lb. per yard. We designed the 80-lb. rail with a head weighing 38·59 lb. per yard., therefore by adding 8½ lb. to the total weight of the rail we got an additional 6 lb. in the head of the rail, and it is the head only that you can wear down with traffic. It was that reason, remember, which induced us to go into the stronger rail. The ordering of the engines in question and the weight to be borne by each axle received the most anxious consideration at the hands of the Commissioners and their officers before the order was given, but, as a further increase in weight might become advisable in future years, I took the opportunity when I was in the old country of discussing the question with Sir Benjamin Baker and Sir John Fowler—two of the most eminent engineers in England. Sir Benjamin Baker unhesitatingly agreed that we could with safety carry 16 tons on one axle on a 70-lb. rail with ironbark sleepers, 9 ft. x 10 in. x 5 in., placed 3 ft. centre to centre. I put a far worse case than our own before him, and he unhesitatingly agreed to that. As Sir John Fowler, Bart., is our consulting engineer I asked him to place his views in writing, which he did in the following words:—

New South Wales Weight of Rails.

2, Queen's-square Place, Queen Anne's Mansions,

Westminster, South West, 22 October, 1891.

Dear Mr. Eddy,

The question you put to me yesterday with reference to the safety or otherwise of allowing locomotive engines with driving wheels having a weight of 16 tons on a pair to work on your 70-lb. rail was an important one, but I have no hesitation in answering it. Provided the sleepers are of ironbark, 9 ft. long by 10 in. wide and 5 in. thick, placed at a maximum distance of 3 ft. centre to centre, and the line, level, drainage, and ballast well maintained, there is no objection or danger in the use of such engines for either passenger or goods traffic. Of course I assume that the rails are renewed before they are worn and weakened according to usual good practice, which may be said to be applicable to rails of all weights; but at the same time I should like you to understand quite distinctly, as my opinion, that with your present and certain increase of traffic, and the power and weight of engines, you are practically compelled to use a rail of 80 lb. per yard, is more economical than one of less weight, from its higher percentage of wearing weight, and its greater length of life before renewal.

Your's, &c.

To E. M. G. Eddy.

JOHN FOWLER.

6608. The Lancashire and Yorkshire Company have running upon their line no less than 366 engines, with a weight upon a pair of driving-wheels of from 16 tons 10 cwt. 1 qr. to 17 tons 10 cwt. There is a diagram of all their engines with their weights. The Great Western Railway Company of England have engines carrying 15 tons 10 cwt., 15 tons 16 cwt., and 16 tons 10 cwt. on a pair of wheels. As I am referring to the Great Western Company's engines, and you had so-called expert evidence the other day upon the weights of rails used by the different English companies by a gentleman who said that he had given the matter a good deal of study, and who spoke from personal knowledge of the rails on the Great Western

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Western Railway seven years ago, his statements being to my knowledge absolutely wrong, I think I might give you a statement by Mr. Wolfe Barry, a very eminent engineer at home, published in the work entitled "Railway Appliances," a book of science, the 90th edition. The expert before you said nothing at all about the bearings, he simply gave facts about the weight of the rails.

6609. *Professor Warren.*] We knew as a matter of fact that they had longitudinal bearing.

6610. *Mr. Eddy.*] He did not say so. He said "The Great Western Railway Company has 86-lb. bull headed rails, with the sleepers 2 ft. 9 in. apart, the sleepers in that case being 12 ft. x 6 in.," and this was seven years ago, but the universal practice for cross sleepers in England is to place them 3 ft. apart. It is a most unusual thing to have them less than 3 ft. apart. Mr. Wolfe Barry, speaking on longitudinal bearings, says:—"There is on the Great Western Railway a rail weighing 62 lb. per lineal yard, which has carried for many years and is now carrying the heaviest traffic, while other companies and the Great Western itself are using cross-sleepers for a rail weighing 75 lb. to 80 lb. per yard."

6611. Well, I do think it is wrong for witnesses to say they have been studying the matter to come here to give expert evidence, and then make a statement of that sort. But I will not be content with the contradiction that I have already supplied, I will give you information up to two days ago from Sir John Fowler, who is the Consulting Engineer of the Great Western Railway, because it is, I think, exceedingly wrong the reputation and the credit of the country, in connection with the Railway Commissioners, should be jeopardised by witnesses who absolutely speak without knowledge of facts. As perhaps Professor Warren may know the Great Western Railway is about to alter its gauge. The gauge was to have been altered last Sunday or this coming Sunday, from broad to narrow gauge, and therefore, it would have been an opportunity for the Great Western Company to put in a new rail, therefore, in cabling to Sir John Fowler, on the 11th instant we said, "Cable rail Great Western between Didcot and Bristol," which is a portion of the line upon which the heaviest of their traffic runs. In reply Sir John Fowler said, "A quantity of 86-lb. very small, nearly whole length is 68-lb. flat-bottomed bridge rails." That was on the 12th of this month, it was merely a repetition of the Baltimore and Ohio statement.

6612. *Professor Warren.*] Does the telegram say that they lay the road with cross sleepers?

6613. *Mr. Eddy.*] It does not say that, but you see the rails are flat-bottomed. I should rather fancy that the 68-lb. rail would be on longitudinal sleepers. Still it was only a question of the weight of the rail that was stated here, and I produce sufficient evidence before the Commission to show the weight of the rail and the carrying power. The Midland Railway Company carry 17 tons 10 cwt. on a driving-axle and express engine. The London North Western carry 15 tons 10 cwt. on each of two pairs of driving-wheels of Mr. Webb's new description of engine, "Greater Briton." The Eastern of France, for the purpose of avoiding running two engines with their passenger trains, has just put to work an engine carrying 32 tons on the two driving-axes, *i.e.*, 16 tons on each axle, their general rail being 69-lb. in weight. But I will not trouble the Commission longer with that as we will put an officer in the witness-box to show you anything you desire to know with regard to the carrying capacity of rails in America in running engines with as great a weight as 17 to 19 tons on one axle at exceedingly high speeds upon rails varying in weight from 56-lb. to 70-lb, and he will give you all the information you desire, but this question being of so much importance I must trespass a little longer upon your time.

6614. Some stress has been laid upon the spacing of the sleepers upon the New South Wales Railways, as compared with those upon English and American lines, and the question has been put in such a way as to lead the Commission to believe that it is the prevailing practice in England to place the sleepers close together, and the New South Wales 3 ft. to 3 ft. 1 in. apart, whereas the reverse is really the case. In dealing with the sleeper question, however, it must be borne in mind that this is not determined solely by questions of strength, but by the facts that a sufficient bearing area must be obtained for the rail on the sleeper, and the sleeper on the ballast, and the class of wood used. With the soft woods in use in Europe and America, it is absolutely necessary that the bearing surface of the rail and the sleeper should be large enough to prevent the rail cutting into the sleepers. In England this is guarded against by using cast-iron chairs, and in America by placing the sleepers close together. Even then continual trouble is experienced in consequence of the rails and chairs cutting into soft woods, which involves constant attention to prevent the roads coming loose. On the London and North-western Railways, for years I remember an experiment of putting pieces of felt between the sleeper and the chair, to prevent the chairs cutting into them, and with that object too we made the base of the chair exceedingly wide. The class of wood, therefore, is a most important material to be taken into consideration in dealing with the permanent-way. The very exceptional ironbark sleepers we possess in this country are so hard and durable that the fastenings retain their hold exceedingly well, and the rail cuts but slightly into the timber. The question of durability is also very important. The uncertain quality of the timber used for sleepers in America renders it necessary for a larger number to be used as a matter of precaution.

6615. A most important point to be considered in connection with permanent-way is the weight of the road as compared with that of the rolling stock passing over it, as the weight of the road, as a whole, measures its resistance to the blows of the traffic. The following statement shows the weight of a mile of permanent-way of our three types of road as compared with the standard main line of a leading English Railway Company. I have had this worked out with the greatest care, and have also obtained from England the exact rate of their Baltic wood sleepers. In England they use Baltic wood sleepers which they creosote to make them last a little longer.

6616. The weight of 1 mile of the permanent-way of this Colony, laid with 75 lb. double-headed iron and steel rails, placed in 27 lb. C.I. chairs, upon ironbark sleepers 9 ft. long x 10 in. x 5 in., 3 feet apart centres, is 384 tons 7 cwt. 3 qrs. and 11 lb. The weight of a mile of our permanent-way, laid with 71½-lb. T steel rails, upon ironbark sleepers 8 ft. long 9 in. x 4½ in., 2 ft. 7½ in., and 2 ft. 8 in. centres, is 282 tons 2 cwt. 2 qr. 15 lb. The weight of 1 mile of permanent-way laid with 71½-lb. T steel rails, placed upon ironbark sleepers 9 ft. long x 10 in. x 5 in., 2 ft. 7½ in. and 2 ft. 8 in. centres, is 346 tons 8 cwt. 1 qr. and 11 lb. The weight of 1 mile of permanent-way of New South Wales, laid with 80-lb. T steel rails, placed upon ironbark sleepers 9 ft. long x 10 in. x 5 in.; 2 ft. 7 in. centres (Standard Road), is 371 tons 1 cwt. 3 qrs. and 1 lb. Now the weight of 1 mile of permanent-way in England, laid with 84-lb. bull-headed steel rails, laid in 45-lb. cast-iron chairs, upon creosoted Baltic sleepers, 9 ft. long, 10 in. x 5 in., 3 feet apart centres, is 344 tons 1 cwt. 1 qr. 4 lb., so that our 75-lb. rail on ironbark sleepers weighs 40 tons per mile more than the 84-lb. steel rail used in England with its 45-lb. cast-iron chairs, in consequence of their having a lighter timber, but then of course beyond the lightness they have not got the resisting power. Sleepers are smashed to pieces with their heavy traffic. There the renewal of sleepers is a very heavy item, but when we come to the

the 71-lb. steel rail used here, and laid upon the lightest sleepers in use on the Western Line, we find that it weighs 282 tons 2 cwt. 2 qrs. and 15 lb. per mile, and with the new class of sleepers it weighs 346 tons odd per mile, which is really more than 2 tons heavier than the road per mile in England, where they have an 84-lb. steel rail. That, I think, shows conclusively that we are, if anything, in advance of the world in regard to the weight of our road. The weight of the standard Baltic timber sleeper in general use on the best lines in England, is 9 ft. long x 10 in. x 5 in. creosoted is 160 lb., and that our ironbark sleepers of similar dimensions is 252 lb. As regards durability the life of the ironbark sleeper may be taken as fully double that of the former. I fancy it is a great deal more, but I wish to be quite within the mark.

6617. *Professor Warren.*] Yes, it is more than double.

6618. *Mr. Eddy.*] In the evidence brought in support of the charges, the rails on the New South Wales railways have been spoken of generally as being laid on sleepers 3 ft. to 3 ft. 1 in. centre to centre, whereas out of our total mileage of 2,180 miles, on no less than 1,650 miles of the road, the sleepers are placed from 2 ft. 7 in. to 2 ft. 8 in. centre to centre on the straight. On the old road where the sleepers were placed 3 feet centre to centre on the straight, the road on curves was strengthened by additional sleepers, the rule having been to place the sleepers as close as 2 ft. 4 in. centre to centre, in sharp curves, less than 15 chains radius, and 2 ft. 9 in. in curves of from 15 to 30 chains radius.

6619. It has also been represented than only a few miles of steel rails heavier than 71½-lb. to the yard exist on our lines, whereas since the Commissioners have been in office, no less than 215 miles of line have been laid with 75 and 80 lb. steel rails, and an additional 55 miles with 71½-lb. steel rails. In regard to improving the ballast of the lines no less than 700,000 tons of ballast have been used. Out of that quantity 600,000 tons have been blue metal, hard quartz, or slag.

6620. In regard to the ordinary repairs to the permanent-way it may be mentioned that for relaying alone there has been paid out of working expenses during the three and a half years the Commissioners have been in office, £230,000. During fifteen years preceding the Commissioners taking office, a sum of £195,000 was paid for the same purpose. This and other important work has been done, and the working expenses reduced by over 5 per cent. per annum.

6621. As practically the whole of the Baldwin engines are working on the Western Line, it will be well to detail the improvements made on the oldest section (Granville to Bathurst), a distance of 132 miles, of which 25 miles are double line. During the past three and a half years no less than 44 miles have been relaid, and more than 60 miles rebalasted and lifted, while on the remaining portion a very large amount of lifting and slight rebalasting has also been done. Before the close of the year we expect the whole of the rails on the western line from Sydney to Bourke, a distance of 503 miles, will be of steel, varying in weight to the yard 71½, 75, and 80 lb. Well, sir, the Commissioners proposed, with your concurrence, to call witnesses to prove the reverse of what these charges would indicate, and then we would ask you to be good enough, after these witnesses have been called, to allow us to make a few general remarks upon matters that have been placed before you.

6622. *President.*] As far as calling witnesses is concerned, yes, certainly, Mr. Eddy, but about allowing the remarks you speak of, if they are evidence well and good, but I do not think it is needful to have anything in the shape of advocacy. If the statement that you have just made is not even amply but fairly borne out, you have made out a very strong case, and one that requires no advocacy. I would rather you leave the question of making remarks until afterwards. This is practically your evidence. If you want to say anything else you shall have an opportunity of doing so, or you can call anybody else as a witness.

6623. *Mr. Eddy.*] Of course I am quite prepared now to answer any question in regard to the evidence that I have just given, if it is a question that cannot be answered by one of our officers as well as by myself. But anything that can be answered by one of our officers, I would rather leave to them to answer, as my time is very precious.

6624. *President.*] That is to say, you want to get away if you can do so.

6625. *Mr. Eddy.*] I do, my hands are very full.

6626. *President.*] If Mr. Hoyle wants to ask you anything he can do so afterwards, unless, indeed, he would like to ask you any question now, in which case I have no doubt you will be prepared to answer.

6627. *Mr. Hoyle.*] No, I have no question to ask Mr. Eddy at present. I would rather have a chance of digesting what he has already stated.

6628. *Professor Warren.*] I would like to have a chance of digesting that, too.

6629. *Mr. Brown.*] Yes, we will get it printed first.

6630. *President.*] We will call you again, Mr. Eddy, and give you ample opportunity of submitting yourself to cross-examination.

6631. *Mr. Eddy.*] I am in a position to answer any questions that Mr. Hoyle or any member of the Commission would like to put now.

6632. *Mr. Hoyle.*] Do I understand that these various documents and maps are put in evidence. I think it would be as well if they were for many reasons, apart from those directly connected with this inquiry.

6633. *Mr. Brown.*] Here are copies of them. (To Mr. Eddy): You don't want the big ones to be taken away, I suppose?

6634. *Mr. Eddy.*] The only one that has not been prepared in the small form is the one behind you, and I will have that done.

6635. *Professor Warren.*] So they are quite ready for binding up in the volume.

6636. *Mr. Eddy.*] Yes, I think it is rather an interesting thing. I was surprised, I must confess, to see that the gradients on our lines are worse than any on the Alpine lines; for although I have been over the Alpine lines, I did not imagine that it was so. It is the difference in curvature that makes them so much more difficult.

6637. *Professor Warren.*] And the rises.

6638. *President.*] Well, Mr. Eddy, it is useless for us to keep you any longer here, but what about your witnesses.

6639. *Mr. Eddy.*] Mr. Fehon is prepared to go on with our case, but, as a matter of fact, we thought my examination would last the whole day, and I don't think we are prepared with anything else.

6640. *Mr. Fehon.*] Would it meet the convenience of the Commission to take an adjournment now until to-morrow afternoon, when we shall be prepared to call our witnesses.

6641. *President.*] Yes, I see no objection to that, provided it will suit the convenience of Mr. Hoyle.

6642. *Mr. Hoyle.*] Yes, perfectly, Mr. President; in fact, I would rather that we adjourned now than continued the inquiry any longer this afternoon.

Mr. E. M. G.
Eddy.
18 May, 1892.

THURSDAY, 19 MAY, 1892.

[The Commission met in the Board-room, Colonial Secretary's Office, at 2:30 p.m.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

ALEXANDER BROWN, Esq., M.L.C., J.P.

6643. *Mr. Hoyle.*] Mr. President: In view of the very important, very complete, and very long statement made by Mr. Eddy yesterday before this Commission, I rise to ask for an adjournment until Wednesday next. I would ask for the adjournment until Tuesday, but that is a holiday, and I therefore feel compelled to ask for an adjournment until Wednesday next. In doing so I wish my object to be clearly understood. In the statement made yesterday by Mr. Eddy reference was made to a large number of railways throughout the world. Mr. Eddy has the command of a large staff to work up information for his use—an advantage which I have not got—and as the statement contained such a large lot of important matter in connection with which it will be necessary for me to make considerable research, the time which has elapsed has not given me an opportunity of doing so, neither has the time at my disposal enabled me to place myself in an efficient position to cross-examine the witnesses—at least not such a position as I should like to be placed in. I think, therefore, that under all the circumstances my request is a reasonable and just one. At the same time I regret to have to make it, because I know that this Commission, as well as the Railway Commissioners, may be put to some inconvenience, but I think it will be admitted that I have in the past attempted, so far as possible, to meet the convenience of every one connected with this inquiry. At the same time I must be just to myself, and as new and very important evidence has been given which I have not had time to thoroughly make myself acquainted with, I trust that my request will be acceded to, and that the Commission will now adjourn until Wednesday next. Instead of sitting on Monday we might, I think, sit on Wednesday, Thursday, and Friday, so that no time will be lost except this one day. After all, taking into consideration the circumstances, perhaps a day's loss will not very much matter. I hope the Commission will grant the request I now make.

6644. *Mr. Fehon.*] I think this is a very unusual request to make at this stage of the inquiry. If the Commissioners had asked for an adjournment to prepare their case I think there might have been some reason in it, but once having opened our case by the statement of Mr. Eddy, which, of course, is evidence, I do not think an adjournment should be granted. It is true that the Chief Commissioner has given evidence of a voluminous character, but I do not see that that is any reason for granting Mr. Hoyle's request. It must be remembered that this is Mr. Hoyle's inquiry; he has brought his witnesses and examined them, and put his case before the Commission, and we submit now that upon the threshold of our case—when we have been put to the trouble and expense of bringing men from the country to support the statements made by Mr. Eddy—an adjournment should not be granted. It is not my intention to introduce any fresh matter into the inquiry, for we look upon Mr. Eddy's statement as a complete answer to the case submitted by Mr. Hoyle, but for the satisfaction of the Commission we intend to call a number of men of various grades in the service to substantiate the statement which has been made before you. I can, therefore, only ask you to consider the great inconvenience and expense which this department has been put to since the commencement of the inquiry, and ask you is it a reasonable thing to stop us now? Mr. Hoyle stated that he experienced some difficulty in dealing with the various matters Mr. Eddy has brought forward. I may call your attention to the fact that Mr. Eddy said that all the authorities for his quotations and statements will be put into the hands of this Commission, and that being so, I presume Mr. Hoyle would have the right to look at these authorities if he questioned any portion of the statement made by Mr. Eddy.

6645. *Mr. Hoyle.*] I would like the Commission to bear in mind, in coming to a decision about my request, that the Railway Department is in a very different position to myself. That department, as I have already said, have a large staff of gentlemen at their command who can go on compiling the case for the Railway Commissioners as the evidence is brought forward, but I, on the other hand, have got my private business to attend to, which gives me, so far as a day is concerned, very little time to consider the case as it is developed. The only time I have at my command for that purpose is after tea in the evening. My position is, therefore, very different from that of the Railway Commissioners. The matter is now in your hands, and if you determine to go on with the evidence, of course I must give way, but if you grant the adjournment I ask I shall be exceedingly pleased.

6646. *Mr. Fehon.*] The Railway Commissioners would not care to oppose anything in reason asked by Mr. Hoyle. He puts his case very fairly, and, perhaps, it may be admitted that we have more assistance at our command than he has, but we are not going to bring forward one item of evidence beyond what has been placed before you already. The evidence we shall bring will be simply in corroboration of what has been stated by Mr. Eddy. Mr. Hoyle will have the right, I presume, of saying something at the termination of the inquiry, and by that time he will have been able to consider the matter in the whole of its bearings, so as to lay his views completely before you.

6647. *President.*] Mr. Hoyle, are there any witnesses present who might be examined this afternoon without prejudice to you. I am only thinking when I say this of the inconvenience to which the Railway Department may be put to by our granting an adjournment. I presume it would be the scientific evidence more particularly that you would like to be prepared for, but if there are some men here belonging to the Railway service who would only depose to facts, would their examination place you in any difficulty with regard to the evidence?

6648. *Mr. Hoyle.*] I do not know who are here. Perhaps if Mr. Fehon would indicate the witnesses who are present I might be able to state whether their examination would interfere with me at all.

6649. *President.*] Is there anybody, Mr. Fehon, who might be examined without objection by Mr. Hoyle?

6650. *Mr. Fehon.*] I would be content if the inspectors and gangers from the country were examined to-day.

6651. *President.*] Would that put you in a difficulty, Mr. Hoyle?

6652. *Mr. Hoyle.*] Well, Mr. President, there is a great deal in the statement made yesterday that is altogether wide of this inquiry, and there are many things I would like to think out. I would press again for an adjournment. It would not be much inconvenience to the Commissioners—only a matter of saving a day—and it would be a great convenience to me to have the inquiry adjourned. 6653.

6653. *Mr. Brown.*] The department say they have two or three gangers here they would like to examine, so that they might then return to their work. Suppose the scientific evidence were set aside—the examination of Mr. Foxlee, for example, or other officers high in the service of the department. If that evidence were postponed, could we not take the testimony of two or three witnesses, such as gangers and others like that. Suppose the Commission grant your request so far as a postponement of the scientific evidence is concerned, would that meet your views?

6654. *Mr. Hoyle.*] Yes; I would be satisfied with that.

6655. *President.*] If there were anything you wanted to cross-examine these witnesses about which was not convenient now, your cross-examination might be postponed. Suppose we take only the men Mr. Fehon has mentioned.

6656. *Professor Warren.*] I suppose that if Mr. Hoyle wants to call a witness he can do so. I do not think any harm would be done to Mr. Hoyle by going on with the evidence of the gangers, but I think any expert evidence—such a high authority as Mr. Foxlee, for example—ought not to be put in the box without Mr. Hoyle having the opportunity he desires. I presume, Mr. Fehon, it is not your intention to put such a witness in the box this afternoon. Is that so, Mr. Fehon?

6657. *Mr. Fehon.*] No.

6658. *Mr. Brown.*] Then you will be content to call these witnesses only?

6659. *Mr. Fehon.*] What I propose to do is to call some gangers on the line over which the Baldwin engines have run, and two or three officers of the department.

6660. *Mr. Brown.*] Who are they?

6661. *Mr. Fehon.*] They are men a grade higher than the gangers.

6662. *Mr. Brown.*] Have you any objection, Mr. Hoyle?

6663. *Mr. Hoyle.*] Yes; I have. I believe one of these officers is an inspector of great ability.

6664. *Mr. Fehon.*] It is rather curious to object to him because he is a man of great ability.

6665. *President.*] So long as you are not excluded, Mr. Fehon, you need not mind, I think. Mr. Hoyle is in this difficulty. The able statement made by Mr. Eddy is likely to occasion him considerable ground for thought and consideration, and I think it is very natural that it would do so, and if, without having given that thought to this statement on account of the short time at his disposal, there are witnesses he thinks he will not be able to examine efficiently to-day, I think it would be fair to postpone their examination.

6666. *Mr. Fehon.*] I would like Mr. McLachlan to be called to put a document in evidence, so that it may form part of the evidence of this Commission.

6667. *President.*] Yes.

6668. *Mr. Hoyle.*] I may mention that I made a request for certain books from Newcastle to be produced by the Railway Commissioners, but up to the present time they have not produced them.

6669. *Mr. Fehon.*] I think they are upstairs.

6670. *The Secretary to the Railway Commissioners.*] I thought they had been sent in to the Commission.

6671. *Mr. Hoyle.*] The books will not go out of the possession of the officers of this Commission, and I do not intend to take anything out of this room, so that they will be quite secure.

6672. *Mr. Brown.*] You will let Mr. Hoyle inspect these books, Mr. Fehon?

6673. *Professor Warren.*] The Secretary will be in charge of them, so that it will be really quite satisfactory to all parties. They will be in the charge of the Secretary to the Commission.

Hugh McLachlan, being sworn, said:—

6674. I am Secretary to the Railway Commissioners of New South Wales.

6675. *Mr. Fehon.*] In connection with the speech made by Mr. Hoyle in Parliament on the 20th August, did the Railway Commissioners prepare, at the request of the Minister for Railways, a statement in regard thereto, dated the 7th October, 1891? Yes.

6676. Was not that document compiled by the Commissioners after discussing the matters thoroughly with their various officers? Yes.

6677. Have you a copy of that document with you? Yes.

6678. Will you hand to the Commission a copy of the same? Yes. [*Witness here handed a copy of the document in question to the Commissioners.*]

6679. *Witness.*] In the copies of *Hansard* containing the speech in question, certain extracts were marked for evidence. The extracts referred to are marked in the margin of this document.

6680. Were the replies to the various statements made in Parliament based on the reports of the various officers in the department? Yes; we quote the names of the officers in full in this document.

6681. Was a further paper prepared on the 18th November, regarding the various defects that had developed themselves in the engines, and sent to the Minister? Yes.

6682. Will you hand to the Commission a copy of the same? Yes. [*Witness here handed to the Commissioners a copy of the document referred to.*]

6683. You have heard most of the evidence given at this inquiry;—have not the failures referred to been simply a repetition to a great extent of what the Railway Commissioners themselves officially informed the Minister of in the papers referred to? Yes; I think the Commissioners will find this to be so by reading the documents I have handed in.

John Brady, being sworn, said:—

6684. My position in the Railway service is that of a ganger.

6685. *Mr. Fehon.*] What part of the road are you engaged on? On Springwood.

6686. What is the present state your length;—I may state to the Commissioners that I intend to ask all the witnesses the same questions? Very good.

6687. Has your length been lifted and ballasted? Yes; all but about 2 miles.

6688. And why has not that been lifted and ballasted;—does it not need it? Not so badly as the other parts.

6689. From your experience, which do you think, two engines coupled together or one Baldwin engine, would knock the road about the most? Two engines coupled together, from my experience.

6690. *Professor Warren.*] They would do more damage, you say? Yes.

6691.

Mr. H.
McLachlan.
19 May, 1892.

Mr. J. Brady.
19 May, 1892.

- Mr. J. Brady. 6691. *Mr. Fehon.*] Have you had more trouble in keeping the road in order since the Baldwin engines have been running than before? Not a bit.
- 19 May, 1892. 6692. Do these engines take the curves more easily than those of other types? Yes, so far as I am concerned they do.
6693. Is your road sleepers with ironbark? Yes.
6694. Did you find the fastenings hold well in those sleepers? Yes.
6695. Did you ever see an ironbark sleeper decay? Yes.
6696. You have seen them rot in the road? An odd one; a very odd one.
6697. Generally speaking, do you consider the Baldwin engines fit engines to run on that road? Yes, I do.
6698. *Mr. Hoyle.*] What length are you on? Springwood.
6699. What rails have you on that length? Double-headed steel rails.
6700. What weight? 75 lb. to the yard, and 42 chains of it is laid with steel T rails.
6701. What is the space of the sleepers in your length? On the curves it is 2 ft. 4½ in.
6702. Is that right through, or does it vary on the straights? It varies on the straights.
6703. Is that the uniform spacing both for the 80-lb. steel and the 75-lb. iron rail;—is the spacing the same for both rails? The spacing for the 80-lb rail is 2 ft 4½ in.
6704. The spacing then is the same? Yes.
6705. Are they all steel rails in your length? Yes; 80-lb. and 75-lb. steel rails.
6706. Have you any broken rails in you length? No.
6707. None whatever? I have seen them after they have been in the press where they have been cut. They might go out a little at the bottom flange, but nothing to hurt. It would be inside the fish-plates.
6708. The double-headed rails you speak of have they been turned? Yes, in two of the curves.
6709. But anywhere on the straight? No.
6710. Did you turn the rails on the curve? No; I did not turn them.
6711. Are there any turned? Yes, there are.
6712. Are your curves true? Yes; in the cuttings.
6713. Do you know the weight of these engines passing over the road? Well, according to what I see in the papers, they are 90 odd tons in weight.
6714. One of these engines weighed 90 odd tons, and there is one case in which the engine weighed 97 tons; there is also another engine by the same company weighing about 87 tons. Do you consider that the engine which weighs 10 tons more than the other is not more injurious on the road than the lighter one?
6715. *Mr. Fehon.*] That is scarcely a fair question.
- Witness.*] I am not an expert, and so I cannot say.
6716. *Mr. Fehon.*] That is scarcely a fair way of putting the question. Every well-informed man in these matters knows that the weight of the engine itself has nothing to do with the wear on the road. It is the weight on the driving-wheel that has to be considered. I suppose, as far as the ganger is concerned, he does not know anything about it?
6717. *Mr. Brown.*] So far as he is concerned, he has already given evidence that the engine is suitable to the road, and I think it is only fair that Mr. Hoyle should have an opportunity of getting from him by what means he arrives at that conclusion.
6718. *Professor Warren.*] Are you speaking of the old Consolidation engine—that is 75 tons, is it not?
6719. *Mr. Hoyle.*] Yes; but there is another, I think, which weighed 87 tons. (To Witness): You were asked just now by Mr. Fehon whether two engines coupled together would be more injurious upon a road than one. Now, remember that these two engines coupled together are each of them lighter than the Baldwin engine. Now, considering that, do you swear that these two coupled-engines, each of which is lighter on the driving-wheel than the Baldwin engine, would do more damage to the road? I believe that the Baldwin engine goes round the curve easier than the other two engines.
6720. *Professor Warren.*] That is not the question.
6721. *Mr. Hoyle.*] The question is, whether the engine with the lighter load on the driving-wheel, would do more harm than the engine with the heavier weight? I do not think it would make any difference to the road.
6722. *Mr. Brown.*] He cannot tell you; he only sees the road and the engines passing over it. It is in, that general way you should ask him the question.
6723. *Mr. Hoyle.*] Your experience has been then, that the two engines coupled together are just as injurious to the road as one engine? Yes.
6724. Now, have the two engines coupled together been more injurious? I cannot say. So far as my experience goes, one is as safe as the other.
6725. How long has the 75-lb. steel rail been in your road? Since 1878.
6726. *Professor Warren.*] With regard to the effect of the Baldwin engine in knocking about the road; in answer to Mr. Fehon, you were saying what you actually saw every day. You do not base your opinion upon the weight itself, but from the work you have to do on the permanent way. Does the Baldwin engine knock the road about? I would as soon see it go over the road as any other.
6727. You have no more extra work to do on account of it? No more than I did before.
6728. The Baldwin engines do not tend to spread the road more? Not so far as I can see.
6729. Then, in the curves you mean to say that they do not tend to spread the road more than the ordinary engines? No; not so far as I can see.
6730. *Mr. Brown.*] Do you put strutting in at a curve? I did do so.
6731. When? Shortly after the road was lifted.
6732. How long ago was that? Over twelve months ago.
6733. *Professor Warren.*] You have not to do more work now than you had to do before;—I mean in consequence of the Baldwin engine being on your line? No.
6734. And your lines are in good order? First rate.
6735. *Mr. Fehon.*] Has it always been the custom to strut in the curve? Always.
736. There is nothing new in it, is there? No.
6737. *Mr. Hoyle.*] How long has the 80-lb. rail been down on your line? Since the beginning of 1891.

John Berghoffer, being sworn, said :—

6738. My position in the Railway Service is that of a ganger, and I have been in the service for eleven years.
6739. *Mr. Fehon.*] What part of the road are you now engaged on? From 65 miles to 70 miles 60 chains.
6740. Yes; but whereabouts is that? At Katoomba.
6741. What is the present state of your length? It is in very fair order.
6742. Has it been lifted and ballasted? Yes.
6743. From your experience, can you say whether two engines coupled together, or one Baldwin engine would knock the road about more? There is very little difference, I think.
6744. Have you had any more trouble in keeping the road in order since the Baldwin engines have been running on your line? No.
6745. You have seen the Baldwin engines running daily? Yes.
6746. Do you consider that they take a curve more easily than engines of other types? I cannot say that they do.
6747. What is their effect on the curve;—do they knock them about at all? No more than the other engines; they seem about equal.
- 6747½. What weight of rail have you on your length? We have two different weights—75-lb. steel rails, double-headed, and the 80-lb. T rail, also steel.
6748. Your road is all steel? Yes; that is on the main road.
6749. Have you iron-bark sleepers? Yes.
6750. Spaced how far apart on the straight? About 3 feet.
6751. We do not want to know "about," give it to us exactly what is your standard distance? About 3 feet seven-eighths, I think.
6752. Is it not a little less than that;—do you say that that is exactly how you lay them the straight? Yes.
6753. On the curves, the light curves and the sharp ones, how many sleepers do you put on the rail length. First of all how many on the sharp curves? On the 30-ft. rail we put twelve sleepers.
6754. How many on the straight? Twelve on the straight.
6755. And if a curve of a larger radius how many additional? On the 24-ft. we put ten sleepers.
6756. Do you ever find any of your sleepers decaying? Yes.
6757. Do you consider the Baldwin engine to be suitable for running on your length of road? Yes.
6758. And do they do any more damage than other engines? No.
6759. *Mr. Hoyle.*] How long have you been upon this length? Nine years.
6760. On this particular length? Yes.
6761. Will you tell me how many sleepers you put on a 30-ft. rail on the straight? Twelve sleepers at present.
6762. *Professor Warren.*] On the straight? Yes.
6763. *Mr. Hoyle.*] And on the curve? Do you mean the 30-ft. or the 24.
6764. How many sleepers do you put to the 24? Ten.
6765. Is that only in the case of the 75 and 80 lb. rails? Yes.
6766. You do that in both cases? Yes.
6767. That is ten sleepers to the 24? Yes.
6768. Since these Baldwin engines have been running have you had any broken rails on your length? None.
6769. None whatever? No.
6770. Do you find that the rails crush much at the chairs or ends? No.
6771. Is your road wavy? Have you indents in your road? Yes.
6772. Do the ends of your rails bend down? Yes.
6773. Do the joints bend down? Yes.
6774. Do you find that to be the case with the 80 lb. rail as well as the 75 lb. rail? No, not so much.
6775. Not so much with the 80 lb. rail? No.
6776. Does the bending at the joints cause you any extra trouble? That always has been the case. It is most of our work lifting joints when they go down.
6777. Are all the sleepers in your length perfectly firm? Yes.
6778. Do you find the sleepers loosening from time to time? No.
6779. You do not? In wet weather they sometimes get loose a little.
6780. Then you immediately pack them? Yes.
6781. Do you know the weight of the Baldwin engines? Only by what I have heard.
6782. They are 90 tons for the passenger and 97 for the goods? Yes.
6783. Do you consider that an engine of that weight has a worse effect upon the road than two engines coupled together? It has not.
6784. Have the two coupled together a worse effect than the one? I do not know.
6785. But do you think they have? I do not. I think they are very much alike.
6786. Is the bottom of your road rocky under the ballast? Only in the cuttings.
6787. What kind of ballast are your rails fixed with? There are different kinds, sandstone, hardstone, and some other ballast.
6788. Have you any blue rock ballast? No.
6789. Do you consider your road in first-rate order? Yes.
6790. And perfectly safe? Yes.
6791. *Professor Warren.*] When you say that the Baldwin engines do not knock about the road more than other engines, do you go simply by the work you have to do to keep it in order? Yes.
6792. You say you have no more work upon your length now than you used to have? No.
6793. You say that you have had a lot of work at the joints, do you find that the 80 lb. rails give you as much work at the joints as other rails? Yes, just about the same.
6794. You have the ordinary fish-plates I suppose? Yes.
6795. They are not angle fish-plates are they? No.
6796. They do not spread over the rails? No, they fit tight.
6797. *Mr. Fehon.*] We use no angle fish-plates at all.
6798. *Professor Warren.*] I am surprised to hear that. I rather like the angle fish-plates.

Mr. J.
Berghoffer.
19 May, 1892.

Charles Low, being sworn, said :—

- Mr. C. Lowe. 6799. I am a ganger employed on the New South Wales Government Railways.
 1 9 May, 1892. 6800. *Mr. Fehon.*] How long have you been in the service? Fourteen years, or thereabouts.
 6801. Were you ever on any other railway work besides this? Yes.
 6802. Who were you employed by before you entered the Government Service? By contractors.
 6803. What part of the road are you engaged upon now? My length goes from 150 miles 40 chains to 156 miles 40 chains.
 6804. Yes; but what do you call your nearest station? The nearest station is George's Plains.
 6805. What is the present state of your length? In very good order.
 6806. Has it been lifted and reballasted? It has been lifted right through.
 6807. What is your opinion about two engines coupled together as compared with one heavier engine, in their effect upon the road. What effect has it on the road;—do you consider that two engines knock the road about more than one engine of a heavier type, or do you think that the one heavier engine would do more damage to the road? That is, two light engines to one big one.
 6808. Yes; which do you think would do the greater amount of damage to the road? Well, in my opinion, it makes no difference. The road is very heavily ballasted. I do not think it makes any difference.
 6809. Have you had any trouble in keeping your length in order since the Baldwin engines have been running? No.
 6810. How do you find the Baldwin engines take the curves? They do not appear to hurt the curves. They do not appear to hurt the line any more than any ordinary engine.
 6811. What weight of rail have you on your length? I have never seen them weighed, but I think they are about 73 lb. to the yard.
 6812. Are they double-headed rails? No; they are steel T rails.
 6813. And you have got ironbark sleepers down there? Yes.
 6814. Do you find the fastenings hold well? Do you mean in the new sleepers?
 6815. Yes; in the new sleepers? Yes; I do.
 6816. You consider the Baldwin engines are suitable for running on the length of road that you have charge of? They do not hurt the length of road that I have charge of in any way whatever.
 6817. *Mr. Hoyle.*] Is all your length of road laid with T rails? Yes; all T rails.
 6818. Was it relaid with new rails when it was lifted? No; not all of it.
 6819. Have any portions been relaid with new rails? Yes.
 6820. What was the weight of the rail? About 73 lb. to the yard. They are not the heaviest rails.
 6821. *Mr. Fehon.*] They are 71-lb. steel rails.
 6822. *Mr. Hoyle.*] What is the space of the sleepers in your length on the straight—how far apart, centre to centre? It all depends upon the length of the rail.
 6823. Well, I hardly see how that can be, but at all events in your length there is nothing more than 24-foot rails. With a 24-foot rail there are ten sleepers.
 6824. And the 21-foot rails—how many sleepers are there to them? There are nine sleepers on the 21-foot rails.
 6825. You have no chairs on your road at all? No.
 6826. And you have no double-headed rails? No.
 6827. And your road has recently been lifted and re-ballasted? Yes.
 6828. With what ballast? With blue metal.
 6829. How long is it since your length was re-sleepered? Well, they did it in 1891—some time last year, but I have forgotten the exact date.
 6830. Was it re-sleepered last year? Partly last year and partly the year before.
 6831. Was it only re-sleepered where you put in new rails? No; all through with the exception of a few chains on the other end.
 6832. And there the sleepers were already good? Yes.
 6833. Have you had any broken rails on that length? No.
 6834. How long have you been on that length? Two years two months and two weeks.
 6835. Where were you before you went there? Before I went there I was at Woodstock.
 6836. What rails were there there? The rails there were similar to those at George's Plains.
 6837. Were they T rails? Yes.
 6838. And was the spacing of the sleepers the same? No; the sleepers were not placed as close.
 6839. What is the spacing of the sleepers on the Cowra line? A 24-foot rail has nine sleepers under it.
 6840. Since these Baldwin engines have been running, have you had any more work to do by way of keeping the line in repair? No.
 6841. You have not had more work to keep your length in order? No.
 6842. What speed do the engines travel over your length? I do not know which portion of the length you refer to.
 6843. I refer to any portion of it. You have curves, and you have gradients on your length? Yes.
 6844. About what speed do the engines travel up the hill—take a Baldwin passenger engine for example? About 20 miles an hour, as well as I can tell.
 6845. At what speed do they come down the hill? They come down the hill at about 30 miles an hour.
 6846. Have you had any trouble with your curves since the Baldwin engines have been running? Not since the road was fixed up.
 6847. But have you had any trouble before it was fixed up? No more than we should have had with any ordinary engine.
 6848. You were on the line before it was fixed up? Yes.
 6849. The Baldwin engines were not running then, were they? No.
 6850. Had you more trouble then than you have now? Yes; I had a lot more trouble.
 6851. Of course you would have, because then you had a bad road, and now you have a good one? Yes.
 6852. *Professor Warren.*] Where did you say your section is? George's Plains.
 6853. Where is that? The second station on the other side of Bathurst, the first staff station beyond Bathurst.
 6854. *Mr. Fehon.*] You see we have taken men from various places along the Western road, where these engines

engines are running, in order that we might give the Commission a fair idea of the general condition of Mr. C. Lowe. the road.

6855. *Professor Warren* (to Witness).] And you have 71½-lb. steel rails? I have never seen them weighed, but I suppose they are about that, I know they are the second size. 19 May, 1892.

6856. Do the Baldwin engines give you more trouble to keep your road in order? Not the least.

6857. And you think that two smaller engines coupled together would knock about the road more than one large one? I do not think there would be much difference.

6858. Supposing you put two Baldwin engines together, would they not knock the road about more than one engine would? I believe they would knock the road about more than one would.

John McPeak, being sworn, said:—

6859. I am a ganger on the New South Wales Railways.

6860. *Mr. Echon.*] How long have you been in the service? I commenced in the service in January, 1877. Mr. J. McPeak.

6861. Have you been in any railway employ before? No; I have been in the Government Railway employ all the time. 19 May, 1892.

6862. What part of the road were you engaged upon? Two hundred and thirty-two miles ten chains to —

6863. But what is your nearest station? It is a station called Mumbil, 233 miles west of Sydney, near Dubbo.

6864. What is the present state of your length? It is fair, there is a fair running top on it.

6865. Has it been lifted and ballasted? It has never been ballasted, only maintenance ballast.

6866. Has it been lifted? A part of it has.

6867. It is in good order, is it? Yes; it is in fair running order.

6868. What is your experience about two light engines coupled together, as against one heavy engine. Do you consider that either the one or the other does more damage to the road? The two engines coupled together will knock the tangents out on the curve, more than one engine would.

6869. Have you had more trouble in keeping your length in order since the Baldwin engine started running? No.

6870. You consider the Baldwin engines take the curves very easily? Yes; they take the curves easily—they keep the tangents better than the other engines.

6871. What is the weight of the rails on your length? They weigh 71 lb. the yard.

6872. They are steel rails, of course? Yes; they are steel T rails.

6873. What space apart are they? Two feet four inches at the joints, and 3 ft. 1 in. intermediate.

6874. How many sleepers do you put on a 30-foot rail on the straight? We do not use any 30-foot rails up there.

6875. Well, how many sleepers do you put under a 24-foot rail? We put nine under a 24-foot rail.

6876. Do you find that the fastenings hold well? Yes; the fastenings hold well in these ironbark sleepers.

6877. Have you ever had any broken rails on your length? Yes.

6878. How many? I have had three within the last two and half years.

6879. Have you had any lately? Yes; I had one on the 7th April.

6880. Do you consider that the Baldwin engines are fit for running on your length? Yes; they are fit to run on the length.

6881. And they do no more damage than any other engine? No.

6882. *Mr. Hoyle.*] How long have you been on this length? I have been on this length three years and four months.

6883. Where were you before that? On the Molong line—the branch line.

6884. You told us just now that you had a broken rail on the 7th of last month? Yes.

6885. Are there many of the Baldwin engines running on your length? Yes; there are a good few. There is one on the mail train, and there is one on the 38 mixed goods—the Limerick—and then there is an occasional goods.

6886. Can you tell us how long before the 7th of April it is since you had a broken rail? About ten months before that.

6887. From your experience, do you consider that the rail that broke was an inferior one—was it too hard? No; it had a flaw in the flange.

6888. I ask you whether it was too hard, because we want to be perfectly fair, and I have had a great deal of experience of rails myself. I have had a rail break with one blow of the hammer, because it has been too hard.

6889. Did you find that the rails which you took out were very hard? Well, it had an old flaw in the flange—the flaw was not visible for daily inspection, because it was covered with the ballast.

6890. Was it broken very far up? It was broken right across the flange.

6891. Did it appear to be an old break? Yes; it was rusty right across the bottom.

6892. You said just now that you considered that two lighter engines coupled together would do the road more harm than one heavy one; you said that they would do more damage to a curve than one engine of a heavier type;—how do you account for that? Well, the two coupled together oscillate to such an extent when they go on to a tangent.

6893. But do you draw your conclusion from the fact that with two engines you get two quick successive blows on the leading wheels of the first and second engines, from the fact that they follow so close one behind the other, two engines not being able to take a curve at the same moment? No.

6894. Well, do you consider that it is the two quick successive blows that do the damage? Yes.

6895. Do you know that it is not so much the four bogie-wheels as the driving-wheels that do the damage? It is the driving-wheel that does the injury.

6896. Well, do you contend that an engine with a light weight on the driving-wheel will do as much injury as an engine with a heavier weight on the driving-wheel? Yes; it will do as much damage as a heavier engine, in my opinion.

6897. Are your curves strutted in any way? No; they are not strutted.

6898. And you say that you have had no more trouble since the Baldwin engines began to run than you had before? No. 6899.

Mr.
J. McPeak.
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6899. And you have had only three broken rails in two and a half years? That is all.
 6900. Have any part of your rails been relaid lately? There was a deviation relaid, but that was all.
 6901. Have you had any new rails put in lately? No.
 6902. How long have these rails been in? About twelve years.
 6903. *Mr. Fehon.*] These gangers, whom we have called as witnesses, represent two from the Mountains and two from the level country beyond. We can bring gangers from each length if necessary, but we thought that in bringing the four men whose evidence you have heard, we should be giving you a good deal of the work along the road where the Baldwin engines are running. As I said before, we have some inspectors here waiting to give evidence, and I do not know whether Mr. Hoyle would object to our calling the two who have come from the west, Mr. King and Mr. Robins. It is Mr. Waring, I understand, that he does not wish to have called until next week.
 6904. *Mr. Hoyle.*] No; if they have to go back, I will not object. I might point out here that up to the present I do not think I have had Inspector Gregory's report. We had to get two reports—one from Inspector Gregory and the other from Mr. Robinson. Mr. Robinson's report has been laid before the Commission, but up to the present we have not had Mr. Gregory's report. Both of these gentlemen took trains to gauge the width of the platforms, and so far they have only had the report of one of them. I should like to have Mr. Gregory's report before me before Mr. Waring comes to give evidence.
 6905. *Mr. Brown.*] Mr. Fehon, this was promised a week ago.
 6906. *Mr. Fehon.*] I believe there is a report from Mr. Gregory.
 6907. *Mr. Brown.*] Will you see that Mr. Hoyle gets it?
 6908. *Mr. Fehon.*] I will see that it is laid on the table.
 6909. *Mr. Brown.*] Well, as long as you see that he gets it I do not care; but we do not want to have any more postponements.

Mr. King, being sworn, said:—

Mr. King.
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6910. I am a sub-inspector of the permanent way on the New South Wales Government Railways.
 6911. *Mr. Fehon.*] What is your district? One hundred and four miles twenty chains to 191 miles.
 6912. You have nearly 90 miles on your road then? Yes; 87 miles.
 6913. How long have you been in the Service? Twenty-three years.
 6914. Have you had any experience in railway work before you joined the service? Only with contractors.
 6915. The road that you have under your charge is a portion of the road over which these Baldwin engines are running now, is it not? Yes.
 6916. What weight of rail have you on your length? Various weights.
 6917. Will you tell us what weights? 80-lb. steel rails, 75-lb. steel rails, 71-lb. steel rails, and 75-lb. iron rails.
 6918. And is your length all sleepered with ironbark sleepers? Well, yes; with ironbark sleepers, but not right through.
 6919. That is to say, that some of the original road was not laid with ironbark sleepers, and yet those sleepers are so thoroughly sound that you do not need to take them out yet? Yes.
 6920. Are all the fastenings good? Thoroughly.
 6921. What is your experience of an ironbark sleeper, as to the quality of wood? It is far superior to a gum sleeper.
 6922. Is there any wood that you know of that is better than an ironbark sleeper? Not for sleeper purposes.
 6923. Do you know the weight of an ironbark sleeper? Well, it just depends on the length of it.
 6924. Well, yours are 9 ft. long x 10 in. x 5 in.;—do you know what an ironbark sleeper that size would weigh? I do not know; I never weighed one.
 6925. I suppose it is heavier than a sleeper the same size made of any other kind of wood, is it not? Yes.
 6926. What is the spacing of your sleepers;—give us the old road and the road that you have been relaying? The straight portion of the old road was sleepered with sleepers 3 feet 1 inch apart, and the curves from 15 chains and upwards had one extra sleeper in every 24 feet, whilst curves 15 chains and under had two extra sleepers to every 24 feet; the system adopted with the new road with 80-lb. rails is 20-inch joints, centre to centre, and 2 feet 7 inches intermediate.
 6927. But is 3 feet 1 inch the uniform thing;—how many sleepers would you have on a 24-ft. rail? Eight on a straight.
 6928. *Professor Warren.*] Well, if you had eight sleepers, how do you make them 2 feet 7 inches apart? Oh, it is the 80-lb. rail that is 2 feet 7 inches apart between the sleepers.
 6929. *Mr. Fehon.*] You have had considerable experience of the Baldwin engines passing over the lines, and from your personal knowledge, and from inquiry of the men of various grades under you, do you consider that they are in every way suitable for the piece of road that is under your care? Well, I have not found any difference in the amount of work necessary to keep the road in repair since they have been running.
 6930. Do you find that they take the curves very easily? Very easily.
 6931. They do not knock them out of line at all, do they? No.
 6932. You have seen these engines, I suppose? Yes; and ridden on them several times.
 6933. You know that the driving-wheel is flangeless? Yes.
 6934. Do you not think that that should make it much easier on the road than an engine that has all the wheels flanged? Well, I should say so.
 6935. However, you have ridden on them, and you think that they ride smoothly and evenly, and are a suitable engine to the piece of road under your charge? Yes.
 6936. *Mr. Hoyle.*] How do you account for the broken rail at Tarana? Well, how could we account for broken rails years ago?
 6937. Well, I am asking you how you account for that rail being broken? I cannot account for it. I do not know any man who could account for it either. You cannot foresee these things.
 6938. Do you consider that it was broken by the Baldwin engine attached to the mail train, or by the wheels of the carriages? It would be very hard indeed to say.

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6939. But have you any opinion as to how it was broken? None whatever.
6940. You are the inspector on the length where the accident occurred? I am.
6941. Can you tell me how many new rails you have put in between Tarana and the scene of the accident? Not many.
6942. Well, I have seen you there on the job, you know, putting them in? Well, I saw you there myself.
6943. How many did you put in? Fourteen of the rails that you are alluding to.
6944. Fourteen new rails? No; they are good second-class rails.
6945. But I am speaking about absolutely new rails;—how many new rails did you put in? None.
6946. Do you swear there were no new rails put in on that part of the road? Yes; I do.
6947. Now, think again; remember you are on your oath, and that I have been on the job;—think again whether you have not put in any new rails since the accident? I have put in rails, but not new ones. The rails which I have had to put in are good second-hand rails, fit for main line use.
6948. They have been used before then? They have been run on slightly before.
6949. Have you discovered many broken chairs in your length lately? Not more than usual.
6950. But have you discovered many broken chairs there lately? Since when?
6951. All that sort of thing is reported to you, I suppose, is it not;—can you tell us about how many you have taken out within the last twelve months? Some thousands.
6952. Is that not a serious matter? Well, it all depends upon the way that the chair is broken.
6953. Have you not had more broken chairs since the Baldwin engines commenced to run than you had before any given time? No.
6954. Are you positive of that? Positive.
6955. You made an inspection of that line since the accident, did you not mark a number of rails in chalk to come out, because you considered them bad? I did.
6956. When you were making your inspection, did you not find a rail with the end broken off like that [*showing the witness a drawing of a broken rail*]? Yes; I did.
6957. Is not that a very dangerous thing to have in the road? Well, it is under the fish-plate.
6958. Yes, I am aware of that; but the end of the rail was off all the same;—did the ganger take it out? Yes.
6959. When did he take it out? I told him to renew it at once.
6960. Was it renewed the Saturday I was there? No.
6961. When did he take it out? On the Monday morning.
6962. Do you not think it was a dangerous thing to leave it in the road after you had discovered it; I measured the rail, and there was a crack 4 inches long in it, through the centre of the holds, down the flange of the rail; do you not consider it was a most dangerous thing to leave it there, and that it would have been better to replace it there and then, even although you had to work all night to do it? Well, it was taken out as soon as we could get another rail to the spot.
6963. That length of rail was lifted, was it not, Mr. King? Yes.
6964. Was it lifted on new or on old ballast? On the spot of the accident?
6965. Not on the spot of the accident merely, but the whole of the rail I am referring to? On old ballast.
6966. And the spot of the accident, what have you done to that;—have you lifted it at all? No.
6967. What have you done to it? We have put in new rails where they were broken.
6968. Have you not put in additional sleepers? No.
6969. Was that a new or old rail, the one that was broken? It was a second-class rail.
6970. *Professor Warren.*] I do not quite understand what he means by a second-class rail? It is a rail which has been slightly used, but has no defects in it whatever.
6971. *Mr. Hoyle.*] Have you any rails between the scene of the accident and the Tarana station that are very much bulged? There are a few.
6972. Were they not discovered by you since the accident—two rails, one that had been worn up to $2\frac{1}{2}$ inches on the top, right through from end to end, and another varying from $2\frac{1}{2}$ inches to $2\frac{1}{4}$ inches in thickness from end to end? Yes; but they have been taken out.
6973. Those rails must have been in the road for some time;—do you not consider that that rail was weakened by reason of the amount of wear that it had had? No; the bottom piece was sound—there was no bulge in it.
6974. But would it not weaken the rail very much to have so much taken off the top of it? Well, I have weighed rails something similar to that one, and they are only reduced in weight from 2 to 3 lb. per yard.
6975. But do you not think that a very big reduction? No.
6976. Supposing a rail was in the road, and was reduced to the extent of $1\frac{1}{2}$ lb., and was then turned over and used on the other side, do you not think that would be weakened considerably? That has not been done since I have been in charge of that section. Rails that have been worn to that extent I take out altogether.
6977. But are there not a number of turned rails in the road? I have not put any of them down.
6978. At 118 miles 27 chains were there not several rails bent very much—lowered very much in the joints? Slightly down in the joints.
6979. Not slightly, but very much bent? As a rule, that is, all joints are likely to go.
6980. *Mr. Fehon.*] I would ask whether this is not degenerating into a question of railway management more than anything else. The Commission is inquiring whether the engines are suitable to the permanent-way, and the President has already ruled that the permanent-way means the road in an ordinary state of repair.
6981. *President.*] You mean to say, Mr. Fehon, that even if the rails were very much bent, it would be merely evidence of negligence, and would not come within the scope of our inquiry?
6982. *Mr. Hoyle.*] May I point out, sir, that we have had a witness in the box who has given very different evidence from that which the present witness is giving now, and my object in asking these questions was to show the value that was to be attached to the previous evidence. However, if you think I had better desist, of course I will do so.
6983. *President.*] Well, the other members of the Commission think that you may go on.

- Mr. King. 6984. *Mr. Hoyle* (to Witness).] Do you think that the Baldwin engines are perfectly safe, running at 40 miles an hour. I am speaking of the straight part of the road, between where the accident took place and Tarana? Yes; I do.
- 19 May, 1892. 6985. Do you consider, also, that the Baldwin engines will do less damage to the road than would be done by two lighter engines coupled together? Yes.
6986. Why do you come to that conclusion? As a rule, two engines take a curve far worse than a heavier engine does. I experienced that with the first American engines which came out. I was a ganger at the time, and there was a great deal of complaint about them going to play the "Dickens" with the road, and, as a matter of fact, they make the road more solid.
6987. Do you think that making the road more solid was necessary? Yes.
6988. Then if you thought it was necessary in the case of the lighter American engine to make the road more solid, how is it that you say the heavy American engines do less injury to the road? They do not hurt the road in the slightest.
6989. You have just said that it was necessary to make the road more solid for the other American engines. You now say that these American engines, which are heavier and longer than they, are doing less damage to the road? It is all the better.
6990. *Mr. Brown*.] You are not answering the question. *Mr. Hoyle* wants you to explain your previous answer.
6991. *President*.] What *Mr. Hoyle* said is this, if he will allow me to put the question. You say that you had to consolidate your road for the other American engines which were lighter than these. Then, how is it that you make out that these engines do not hurt the road? When the former engines came out the complaint was that they would hurt the road; but after they had been running on the road we found that they had done the road good by consolidating it, and that they had not injured the road at all.
6992. *Mr. Brown*.] Then for the benefit of the road all the Commissioners want to do is to get heavier engines still?
6993. *President*.] I suppose they make it settle down better.

Edward Robins being sworn said:—

- Mr. E. Robins. 6994. I am an Inspector of the permanent-way on the New South Wales Railways.
- 19 May, 1892. 6995. *Mr. Fehon*.] What is your district, *Mr. Robins*? Between Wallerawang and Bourke, and on the Molong branch.
6996. How long have you held the position of Inspector? Since September, 1880; but not all the time on this side. Previously I was on the southern side.
6997. But you were in the railway service? Yes.
6998. And have you had any experience prior to that? Yes; I was over twelve years a ganger, and altogether I have had over forty years experience in railway work.
6999. And you have always been on permanent-way work? Well, on construction and permanent-way work.
7000. What weight of rails have you on your length from Wallerawang to Bourke? 80-lb. steel rails, 71½-lb. steel rails, both of them T rails, and 75-lb. iron double headed, and 75-lb. steel double-headed rails.
7001. And ironbark sleepers? Yes, ironbark sleepers.
7002. What is your experience of ironbark sleepers? Oh, they are the best sleepers I ever saw.
7003. Do you know the weight of an ironbark sleeper? We used to call them eight to the ton when we were putting down the southern line. That was the coast ironbark.
7004. And you consider them more durable and fitter in every respect for their work than any other class of wood? Yes.
7005. What is the standard spacing of sleepers on the straight. What have the instructions been since the Commissioners have had charge of these lines regarding the placing of sleepers centre to centre? 1 ft. 8 in. joints, and 2 ft. 7 in. intermediate sleepers.
7006. And what was the spacing of the old sleepers? The old sleepers were placed 2 ft. 4 in. apart at the joints, and 3 ft. 1 in. intermediate for straights and light curves.
7007. Has your road generally been relifted and ballasted to a great extent? Yes.
7008. You consider it in good order? Yes; in very good running order.
7009. I suppose the Baldwin engines are running altogether on your length? Yes.
7010. What has been your experience of the permanent-way since the Baldwin engines have been running. Do you find the permanent-way has been injured more by them than by other engines? No, I do not.
7011. Have you ridden on the Baldwin engines yourself? Yes, many times.
7012. And you consider them easy to ride on? Yes.
7013. And they take the curves very well? Yes, easier than some of the other engines.
7014. On the whole, you consider that the Baldwin engines are suitable to the road from Wallerawang to Bourke? They are the best and easiest engines that I ever rode upon.
7015. And as to the load they take, of course there is no question that they do a great deal more work than any other engine? Oh, they take heavier loads.
7016. *Mr. Hoyle*.] Can you tell me, *Mr. Robins*, what distance you have ridden on these engines? That I cannot, because I have been so many years riding on them.
7017. Yes, but I mean on the Baldwin engines? I have ridden some hundreds of miles since they came out here.
7018. Yes, but I mean at one stretch? Yesterday, I rode from Orange to Bathurst on a goods engine, and last Monday I rode on a passenger engine.
7019. What speed were you going at? About 25 miles an hour.
7020. What other engines have you ridden on? On all classes of engines that the Government have got.
7021. In what respect are these engines easier than the other engines? They do not seem to jolt you; there is not a movement in them—probably because they are so well balanced, and are fitted with springs.
7022. But would that be any indication of the effect of them upon the road? Well, some engines are jolting up and down all the time, whilst these engines do not move you at all.
7023. You are the Chief Inspector from Wallerawang to Bourke? Yes.

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7024. Can you tell me how many broken rails have been taken out of the length between Tarana and the scene of the recent railway accident? For how long?

7025. Say for the last twelve months? About two broken, I should think. At all events, that is all that I know of.

7026. Is it the duty of the men to report to you when they take broken rails out? Two broken rails were taken out in addition to the two that were taken out of the line upon which the accident occurred.

7027. Yes, but are these matters reported to you? No, not always. I may be away at Bourke, and then the boy in the office would send it on at once to the Engineer's office.

7028. There have been no more than two broken rails within the last twelve months, at all events excepting those broken by the Tarana accident? There might be, but I have heard of no more than two.

7029. Do you consider that the piece of the road between Tarana and the scene of the accident is quite safe for the Baldwin engines to run over? Yes, it is very fair.

7030. You have heard of no complaints from your gangers as to the knocking of the road about by these engines? No.

7031. Do you know whether slow-down notices have been posted on the bridges? Yes.

7032. Why is that? Because there is one bridge under repair, a bridge at 120 miles 3 chains.

7033. Is that the only place where they have slow-down notices on the bridges? No; they have slow-down notices generally to run over bridges at the rate of 15 miles an hour.

7034. Are there not slow-down notices on other bridges beside the one under repair? Yes; they have to run 15 miles an hour only on the bridges between Sodwalls and Tarana.

7035. Can you tell me why that is? No, I cannot say why it was.

7036. How long have you been an inspector? Three years on Western Division and 8½ years Sub-Inspector on Southern Division.

7037. You were not there when the Royal Commission on bridges sat? No.

7038. What is the spacing of the sleepers on the road where it was not relaid, between Sodwalls and Tarana station? Not where it was relaid, but between those points, the sleepers are placed 3 ft. 1 in. on intermediate lengths, and 2 ft. 4 in. of the joints.

7039. Are there none more than 3 ft. 1 in. apart? Well, it is just possible that in repairing the road a fletcher might knock a sleeper an inch one way or the other.

7040. Are there many broken chairs there? There are always a good many chairs breaking.

7040½. Can you tell us how many have been broken during the last twelve months? No, we do not keep any account of them.

7041. And you do not think these Baldwin engines are doing any more injury to the curves than any other engine? No, I do not think they do; they seem to take the curves much easier.

7042. You say they take the curves much easier, but considering they are heavier engines, and much heavier on the driving-wheels, also heavier on the bogies than the other engines, can you tell me why they ride so much easier on the curves? Because they are on such good springs.

7043. Do you know what is meant by the rigid wheel base? Yes; where the wheels are coupled together, I suppose.

7044. Yes; where the wheels are coupled together, and the connection-rods and the side valves are? Yes.

7045. Well, the Baldwin engines are much longer on the rigid wheel base than most English engines are? Yes, but there is no flange on the middle wheel.

7046. Well, even admitting that, how do you account for these engines riding easier on the curves? Well, they seem to ride easier, that is all. I am no engineer.

7047. Have you strutted your road on the curves? No; I do not believe in strutting the curves, I believe in curving the rails so that they will stand.

7048. Have you put in many new rails recently where the 75-lb. iron rails are? Well, we change them as they were. We take them out and put others in.

7049. Do you know whether any orders were given to relay the road some short time ago? How long since?

7050. I saw the iron rails as I passed along between Sodwalls and Tarana, were not those rails put there on purpose for relaying the road? No, the rails you are speaking of were put there by mistake. I ordered the men to put them out at 113 miles 40 chains to 114 miles 60 chains, and he laid down where you indicate, and had to shift them again.

7051. You say that they were put there by mistake? Yes; and they had to be moved.

7052. *Mr. Fehon.* Are chairs ever broken by the gangers and fletchers in driving keys? Yes; and the breaks are sometimes hidden under the rails.

7053. Do you know a class of engine called the Vulcan? Yes.

7054. Are they pretty rough on the road? Yes.

7055. Much rougher than the Baldwins? Yes; they are 6-wheeled coupled engine, with flanges on all the wheels.

7056. *Mr. Hoyle.* Do you say that the Vulcan engine is a 6-wheeled couple? Yes.

7057. You are wrong there, they are only 4-wheeled coupled engines? Well, I think the 6-wheeled coupled engines are the heaviest on the road.

7058. Then how is it that the Baldwin engines are easier than the Vulcans—because they are 6-wheeled coupled engines? Yes, but the middle wheel is flangeless.

7059. Do you consider that the Baldwin engines are very much easier on the road than the Scotch Yankees? Yes, they are.

7060. Well, as the Scotch Yankee has got a flangeless wheel, how do you account for that? All I know is that I have been on the Scotch Yankees and they ride rougher; the difference must be in the springs, I think.

7061. *Mr. Fehon.* That exhausts all the country witnesses.

7062. *President.* Well, we will adjourn until Wednesday, and sit on Wednesday and Thursday and Friday.

7063. *Mr. Hoyle.* This question of the bridges has come up and Professor Warren has stated that he will not take any responsibility about any bridge to which his attention has not been specially directed. I would therefore direct his attention specially to the Glenlee Bridge and ask him to be good enough to see it for himself before the Commission sends in its final report.

7064. *Professor Warren.* I will do that.

WEDNESDAY,

WEDNESDAY, 25 MAY, 1892.

[The Commission met in the Board-room, Colonial Secretary's Office, at 3.30 p.m.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

ALEXANDER BROWN, Esq., M.L.C., J.P.

Richard Waring, being sworn, said:—

- Mr. R. Waring. 7065. I am Chief Inspector of Railways in the employment of the Railway Service of New South Wales.
 25 May, 1892. 7066. *Mr. Fehon.*] How long have you been connected with the New South Wales Railways? Thirty-three years and five months.
 7067. Have you any other experience besides that? Yes; I had five years' experience besides that.
 7068. And your time has been altogether taken up in connection with works on the permanent-way? Yes.
 7069. You are well acquainted with the material used in the formation of the permanent-way on the New South Wales Railways? Yes.
 7070. Will you give us the weight of the rails used on our lines;—what is the standard rail now being used? There are 80-lb. steel T rails.
 7071. And what other rails? Double-headed 75-lb. rails, also 71½-lb. steel T rails, iron rails 75-lb., double-headed iron and 71½-lb. T rails.
 7072. And the road is laid throughout with very little exception with ironbark sleepers? Yes.
 7073. There is no other wood in the country so fit for sleepers as ironbark? There is none equal to it.
 7074. And it will compare with any other wood in the world? Yes.
 7075. And that you have ever seen with regard to stability? Yes.
 7076. Considering the weight that there is passing over these lines, do you consider that they are sufficiently heavy;—the question of weight is a very important one in passing trains along the line, is it not? It is.
 7077. What is the present standard for the spacing of sleepers on all the new lines laid down? At the joints it is 1-ft. 8-in., in the intermediates there are 2-ft. 7-in. centres.
 7078. And what was the old road laid at? On straights and curves of above 30 chains it was 2-ft. 4-in. at the joints, and the intermediates were 3-ft. 1-in.
 7079. Is the road throughout well ballasted? Yes; thoroughly well, as a rule.
 7080. Are not the New South Wales Railways in a better condition with regard to their permanent-way than any roads you have ever known in your experience? Yes.
 7081. *Mr. Brown.*] I suppose he is speaking of the whole of the railways?
 7082. *Mr. Fehon.*] Yes; the whole. (To Witness.) Have you noticed any particular effect upon the road through the running of the Baldwin engines on the line? I have observed no difference whatever.
 7083. Either one way or the other? No; I have not noticed any difference.
 7084. Do you consider the permanent-way of the New South Wales Railways well suited for carrying such engines as the Baldwin passenger and consolidation engines? I do.
 7085. *Mr. Hoyle.*] Have you any iron rails weighing 70 lb. on any part of the permanent-way? We have 71½-lb. iron T rails.
 7086. Iron T rails? Yes.
 7087. Where are they? On various portions of the line.
 7088. Any on the western portion? Yes.
 7089. Can you tell us where? At least not exactly on the western line; there are 11 miles 52 chains on the Richmond line.
 7090. I do not think these engines are running on the Richmond line, are they? No.
 7091. Any outside of the Richmond and Windsor line? No.
 7092. Are there any on the Northern line—any between Newcastle and Wallangara? Yes; there are some between Newcastle, Werris Creek, and Tamworth.
 7093. Do you know the piece of road where the accident occurred recently? Yes.
 7094. Have you examined that part of the road recently? I have.
 7095. Did you examine it before the accident took place;—was that examination made at an early period before the accident happened? Not immediately.
 7096. How long before? About nine months before.
 7097. What state was it in then? Not in the best state.
 7098. Has anything been done to it since? It has been lifted.
 7099. Was it lifted within the last nine months? Yes.
 7100. Was that done with old or new ballast? With old ballast. The old ballast is equal to the new, it is got from the same place.
 7101. Do you know if the contractor made any objection to lifting it on the old ballast? Not to my knowledge.
 7102. Do you remember some alterations being made to the coal-stage at Eveleigh yard? That was not carried out under my supervision, so that I cannot say anything about it.
 7103. Well, I shall not ask you the question under those circumstances. Do you know the Scotch-Yankee engine? Yes.
 7104. And the old Consolidation engine? Yes.
 7105. Do you consider the old Consolidation engine or the Scotch-Yankee engine injure a road more than the present Baldwin engines? I have not seen any perceptible difference between the effect of them.
 7106. I place a great deal of importance on your testimony, Mr. Waring, as I have known you for a very long time now. You say you did not find any perceptible difference between the effect of the two? I have not seen any perceptible difference.
 7107. Do the present Baldwin engines have any more injurious effect upon the roads than the engines you had formerly? No; I do not see any difference.
 7108. Do you consider that with the sleepers spaced 3 ft. 1½ in. the road is perfectly safe, considering the age of the rails upon it, and considering that a number of them have been turned over, for Baldwin engines to pass over, with the weight they have on their driving-wheel? Yes; I do.

7109.

109. At the speed of 40 miles an hour? They never travel at that rate there.
110. Do you mean to say they do not travel at that rate upon the straight? Where do you get the straight on that section of the road.
111. Well, there are straight portions on the line. At all events, do you consider the Baldwin engines to be perfectly safe on that line? I do.
7112. Are the broken rails taken out of the permanent way reported to you? No; the reports do not come to me.
7113. Do you remember the Vulcan, the 4-wheeled couple? Yes.
7114. Would that engine be more injurious on the permanent way than the old consolidation engine or the present Baldwin engine? The Vulcan is rougher than the Baldwin engine.
7115. Why? I cannot explain, I am not a mechanical engineer. But anyone riding upon them, as I have done, will experience a difference.
7116. Then, you say she is rougher on the road? Yes.
7117. While you were Inspector did you receive any complaints from your Sub-inspectors about the Vulcan engine doing more injury than the other engines? No.
7118. Not from your gangers or fettlers? No.
7119. *Professor Warren.*] You said that there were certain 71½-lb. iron T rails on the roads? Yes.
7120. Do the Baldwin engines run over them? No, not at the present time.

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7121. *Mr. Brown.*] I think the Commission will have to recall Mr. Halligan with regard to question 2195 in the minutes of evidence. It is as follows:—

2195. Have you made any alteration to them (the platforms) since the Baldwin engines came here? We made some alterations to the buildings, but not to the platforms.

2196. You are quite sure? Yes.

Also:—

2200. Then you say positively that no alterations were made to the Murrurundi and Farleigh platforms since the engines came here? Yes, I say so.

Mr. Halligan wants to alter the word "here," to "Newcastle," in both of these questions, in order to make his answer correct. Mr. Hoyle points out that in one of the books, with regard to repairs produced by the Commission, and from the Newcastle line an entry is made as follows:—"Altering platforms to give clearances for the new locomotives." For the purpose of examination, so far as Mr. Hoyle was concerned, it was material Mr. Halligan should have made the statement he did, so that we think he should be recalled in order to give him an opportunity of correcting his evidence, if he wished to do so, and also of course of being cross-examined upon it.

James Fraser being sworn, said:—

7122. I am in the employment of the New South Wales Railway Department, and at present occupy the position of Assistant to the Engineer-in-Chief. I have been in the Department altogether 14 years.

7123. *Mr. Fehon.*] How long have you been altogether on the Construction and Existing Lines Department? Fourteen years.

7124. In your experience in connection with the railways, have you found the ironbark sleeper of exceptional quality? Yes, it is the finest that can be used.

7125. What are its principal advantages? They are its weight, great strength, and durability.

7126. Do these sleepers hold their fastenings well? Yes, exceedingly well.

7127. And exposure has very little effect upon the wood? Practically none.

7128. What is the spacing of sleepers on all roads at present renewed? Two feet seven inch centres.

7129. And the weight of the rail used? Eighty pounds to the yard.

7130. And the material is steel? Yes.

7131. Is not a great portion of the Railway now spaced with sleepers 2 ft. 7½ in. apart? Yes, about 1,650 miles

7132. The original spacing of a large portion of the road with 71½ steel rails was with sleepers 2 ft. 7½ in. apart? Yes.

7133. That is out of the total mileage of about 2,200 miles, 1,650 miles have sleepers spaced 2 ft. 7 in. to 2 ft. 8 in. apart? Yes, the total mileage is 2,179 miles, that is the exact number.

7134. Where the sleepers are 3 feet apart on the straight, are not special steps taken to strengthen the line at the curves.

7135. To what extent? From 30-chain to 15-chain curves the sleepers are placed at 2 ft. 9 in., and on curves less than 15-chain they are spaced 2 ft. 4 centres.

7136. Do you consider the lines to be well ballasted at the present time? Yes.

7137. Are not they in better order now than at any time previously you have known during your fourteen years experience? Yes; they are in very much better condition.

7138. You know the amount of ballast the Commissioners have put on during the time they have held office? About 700,000 tons.

7139. And the greater portion of that is of what class metal? About 600,000 tons of it is blue metal.

7140. It is ballast of a high quality? Yes; the finest quality.

7141. What is your experience with regard to the effect of the Baldwin engine on the permanent way? So far as I can judge by seeing the effect on the road, I do not think that they have any detrimental effect upon it.

7142. These engines are not detrimental to the road you say? No; certainly they are not.

7143. There has been evidence given here of alterations to platforms;—were not a large number of the platforms allowed to stand as they had been originally constructed? Yes; a very large number.

7144. And those which were altered were such as were not up to the standard gauge laid down by Mr. Whitton? No; they were within that gauge.

7145. *Professor Warren.*] They were narrow you mean? Yes; they were within the standard laid down by Mr. Whitton.

7146. *Mr. Fehon.*] If all the platforms had been built in Mr. Whitton's gauge, no alterations would have been necessary to enable the Baldwin engines to pass? No, sir; that was proved in one case. On the Blayney section, from Harden to Blayney, the Baldwin engine ran through without alteration being made to any of the platforms.

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Mr.
J. Fraser.
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7147. One of the charges made against the Railway Commissioners is that in consequence of the great weight of these engines—the Baldwin passenger and Consolidation—the safety of the permanent-way is likely to become endangered;—what is your opinion with regard to that charge? I do not think there is the slightest danger of the safety of the permanent-way being endangered.

7148. You consider that the Baldwin engines are well suited to the permanent-way of this Colony? Yes; the permanent-way is quite suitable to carry them safely.

7149. *Mr. Hoyle.*] I understand you to say that you are Assistant to Mr. Foxlee? Yes.

7150. Do you remember some alterations being made to the coal-stage at Eveleigh? That was before I was appointed Assistant to the Engineer-in-Chief.

7151. But you were in the Department at the time? Yes; as Divisional Engineer at Goulburn.

7152. You say you consider the permanent way to be suitable to carry the Baldwin engines—that, I suppose, is with the 80-lb. steel rail, which I myself consider perfectly safe for carrying these engines—but, taking a 75-lb. iron, and a 75-lb. and 71-lb. steel rails, do you consider that they are perfectly safe for carrying a Baldwin engine travelling at the rate of 40 miles an hour? Yes.

7153. Would it be equally safe with 75-lb. and 71-lb. iron rails with sleepers spaced 3 feet 1½ inches apart? There are none spaced so.

7154. I am speaking of the iron rail;—do you say there are none of them spaced at that distance? Yes, now I think of it, I believe there are—71½-lb. iron rails and part of them are supported by sleepers 3 ft. 1½ in. apart.

7155. Do you consider a Baldwin engine passing over that line perfectly safe? Yes.

7156. *Mr. Fehon.*] They are not running on that part of the road at all.

7157. *Mr. Brown.*] Unfortunately our Commission uses the words “Unsuitable for the permanent-way of the New South Wales Railways,” and although they may not be running along the line in that locality, still they may be required to do so at some future time, and we have to take into consideration whether they are suitable for doing so or not.

7158. *Professor Warren.*] At the same time it is quite right for Mr. Fehon to point out that they are not running in that locality.

7159. *Mr. Hoyle.*] They were running on express duty at Newcastle.

7160. *Mr. Brown.*] But they are not running now.

7161. *Mr. Hoyle.*] But they might be used for that purpose.

7162. *Mr. Brown.*] Certainly, and therefore for that reason the Commission has not shut out this evidence.

7163. *Mr. Hoyle.*] Do you consider that they are perfectly safe, and that they do not knock the road about? They certainly do not knock the road about.

7164. *Professor Warren.*] You asked him if the 71½-lb. rails with sleepers 3 ft. 1½ in. apart were safe. I do not think he answered that.

7165. *Witness.*] Yes; I think they are perfectly safe.

7166. *Mr. Hoyle.*] Running at a speed of 40 miles an hour? They are not running at a speed of 40 miles an hour.

7167. *Mr. Brown.*] I should think the Commissioners, where the sleepers were spaced at that distance, would take the necessary precautions for the public safety by slowing down the speed.

7167½. *Mr. Hoyle.*] Well, this road that is perfectly safe, does it keep in good order? Yes; very good order.

7168. Is there any more trouble with it than with the road where the 80-lb. steel rail is used? No; no more where the road is well boxed up and ballasted.

7169. And why do you put in an 80-lb. rail? For economy.

7170. Do you consider, then, that a 71½-lb. iron rail that has been run upon, and which evidence has been brought to show was reduced by 1½ lb. by wear and tear, and then turned over, is safe for these engines to run upon? The 71½-lb. iron T rail is never turned.

7171. I am referring to the 75-lb. double-headed iron rail. This rail, it has been shown, has lost 1½ lb. through wear, and has then been turned over. Do you consider that rail would then be safe? Yes; I think so. I think it would still be safe.

7172. *Professor Warren.*] You say that a 71½-lb. iron T rail, supported by 3-ft. 1½-in. sleepers, would be safe for the Baldwin engine to run over? Yes.

7173. Would you tell us the minimum weight of rail that could be used for carrying a Baldwin engine—I mean a T rail, with the sleepers 3 feet 1½ inches apart. What should be the minimum weight of such a rail to carry a Baldwin engine with safety? I could not say. I think a rail of 69 lb. iron would carry it with safety.

7174. If you were making calculations, you would not make them on the basis of treating the rail as a fixed beam;—would you calculate the rail, considering it as a beam? Yes; I think you could calculate it that way.

7175. Would you place any reliance on such a calculation? Well, you would not get really good results.

Mr. W. T. Foxlee recalled:—

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W. T. Foxlee.
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7176. *Mr. Fehon.*] Are you a member of the Institute of Civil Engineers? Yes.

7177. How many years have you been employed in connection with railway construction and working? About twenty-five years.

7178. Are you thoroughly acquainted with the mode of construction and maintenance adopted by the principal English railway companies? Yes.

7179. It has been stated that in consequence of the extra width of the Baldwin engines or their great length the platforms in various parts of our lines have had to be altered, is that correct? No; they have been altered to bring them back to the standard gauge, that is to say those which were out of gauge have been brought into gauge.

7180. Is it not a fact that as far back as 1879 reports were made that certain engines, then placed upon the lines, could not pass the structures then existing? Yes; that is a fact.

7181. *President.*] What is a fact?

7182. *Mr. Fehon.*] That as far back as 1879 objections were made to certain platforms being too near the rails. (To *Witness.*) Do you produce a paper in confirmation of this statement? I do. [*Paper produced and put in.*]
7183.

7183. To enable the engines referred to therein to run on the Western line, were not a number of structures altered and in many instances lines slewed to admit them to pass? Yes.

7184. Was not the width of those engines over the cylinders slightly in excess of the width over the cylinders which the Baldwin engines, now under discussion, were ordered to be? Yes; they were slightly over the width of the Baldwin engines—the new Baldwin engines.

7185. If the works and rails in connection with the permanent-way had been kept to the gauge adopted by Mr. Whitton, the late Engineer-in-Chief for Construction, would it have been necessary for the Railway Commissioners to have spent any money whatever to admit of the running of the Baldwin engines over the whole of the line? Not a penny.

7186. What is the total amount of money that has been expended to enable the engines to pass over all the main lines and many of the branches? A little over £3,000.

7187. Is this expenditure not a very small one, as compared with the great advantages gained by the change? Undoubtedly.

7188. Is it not a fact that the question of making these alterations had been prominently before the Railway Commissioners long before the Baldwin engines were ordered? Yes. When the Commissioners took office, the whole question was taken in hand, and instructions were given for the matter to be gone into, and measurements taken, in order to find out exactly which of the structures were out of gauge.

7189. So as to bring them all to a uniform gauge? Yes.

7190. *Mr. Brown.*] Whose fault was it, if there was a uniform standard gauge laid down by Mr. Whitton that this otherwise unnecessary work had to be done?

7190½. *Mr. Fehon.*] A great many of the platforms were taken over from the contractors before they were finished by them, the people being anxious to have the platforms so as to use them. They were taken over by the Construction Branch, and built by the Existing Lines Branch under Mr. Cowdery.

7191. *Mr. Brown.*] But still the uniform gauge was in existence, and some one should have seen to it that the platforms were made in conformity with it.

7192. *Mr. Fehon.*] Oh, undoubtedly. The platforms varied from 8 inches to 1½ inches out of gauge.

7193. *Mr. Foxlee.*] The return I have put in will show that the platforms varied and were at all sorts of distances from the rails.

7194. *Mr. Brown.*] Then it is plain someone blundered? Yes.

7195. *Mr. Fehon.*] It has been stated that in consequence of the great weight of these engines—the Baldwin passenger and Consolidation—the safety of the permanent-way is likely to become endangered, our standard rail being 71½-lb. per yard, whereas the Baldwin engines were designed for an 80-lb. rail. Did not the Commissioners immediately after taking office adopt as a standard rail for the New South Wales railways a steel rail weighing 80-lb. to the yard? Yes.

7196. So that 71½-lb. to the yard is not our standard of rail? No.

7197. And do you consider that the permanent-way is likely to be injured by these engines running over it? Not in the least.

7198. At the present time are there not more than 200 miles of road laid with the 80-lb. steel rails? Yes.

7199. That is since the Commissioners took office? Yes; there are over 200 miles laid with the 80-lb. steel rail, and some 70 miles with the 71½-lb. steel rail, making a total of 270 miles of steel rails.

7200. And that is since the present Commissioners took office? Yes.

7201. What is the standard spacing of the sleepers adopted by the present Commissioners? Two feet 7 inches from centre to centre on the straight.

7202. *President.*] And the same on the curves? Yes.

7203. *Mr. Fehon.*] So far as the spacing between the sleepers is concerned there is no difference made between the straight and the curves? No.

7204. What are the dimensions of the sleepers now used? Nine feet long, 10 inches wide, 5 inches thick.

7205. Are they not exceedingly heavy compared with the sleepers used in other parts of the world? Yes; we take them to average 252 lb., whereas the average weight of the Baltic timber creosoted sleeper of similar dimensions to our own used on the English railways is 160 lb.

7206. What is the lightest rail used on the western line? On the main western line?

7207. Yes? Seventy-one lb. iron and 71½ lb. steel.

7208. In regard to the weight of rail;—when a rail is about 70 lb. in weight per yard, is it not a question of economy rather than security to add to its weight? Yes; we take that as our practice now. Anything above 70 lb. we regard as being used for reasons of economy.

7209. That is to say, that you would consider a steel rail 70 lb. to the yard on ironbark sleepers, spaced as under the present standard, capable of bearing any weight that may be placed on the driving-wheels of the engines that are running upon the New South Wales railways? Oh, yes; thoroughly so.

7210. And even capable of carrying a greater weight? Yes.

7211. Although the Baldwin engines are much heavier than other engines in use upon the lines, does not the distribution of weight over a greater number of wheels do away with any disadvantages arising from extra weight? Yes; we do not find these engines, though they have a somewhat heavier weight on their axles, tell injuriously upon the road at all.

7212. And do you not consider them easy and flexible upon the road—are they not easy running engines? Yes; all the reports I get tend that way, and from my own observation I have no doubt that they are quite as easy, if not easier, than the heavy engines previously used on the lines.

7213. Does not this, therefore, even considering the extra weight, make them much more easy upon the lines when passing round curves. I refer more particularly to their flexibility? Yes; and the absence of a flange on the driving-wheels also helps to ease them when running round the curves.

7214. You have been over the lines recently? Yes.

7215. What is your opinion of the permanent-way of the New South Wales railways from end to end? Speaking generally, it is in very good order.

7216. Do you consider the permanent-way of the New South Wales railways equal to a large portion of the roads of the English railways? Quite, and a considerable portion is better.

7217. What is the prevailing practice in England with regard to spacing of sleepers? Three feet apart centres.

7218. What length of the railways of New South Wales at the present time have the sleepers spaced 2ft. 7in. and 2ft. 8 in. apart? About 1,650 miles.

7219. Is there not an enormous advantage gained upon our railways over the English by having our very hard ironbark sleepers? Certainly.

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7220. I think you stated the class of wood in use in England on the railways? Yes; it is soft Baltic timber.

7221. And because of the softness of the wood, and to ensure the rail being safely secured upon the sleepers, what course is taken by these Companies? To distribute the weight a broad cast-iron chair is used, with four fastenings. That is the usual practice.

7222. In consequence of the sleepers being soft, chairs are used more frequently in England to keep the rails in their place than where they have solid hardwood sleepers, such as ironbark? Yes.

7223. *President.*] Do they not have four fastenings to the chairs here? No; not in the case of the rails, but there is an extra spike put in in the case of sharp curves.

7224. I was only asking on account of something I saw on a suburban line; I arrived at my station too early this morning, and during the time I was waiting I looked at the chairs holding the rails on the line, and I certainly saw four holes for fastening them? Oh, yes; that is so in the case of the bull-headed rails which we have used on the suburban line where chains are of course used. As a matter of fact, although there is provision made in the chairs for four fastenings, we only find two to be necessary on account of the hardness of our sleepers. They (the fastenings) are placed diagonally, so that when the holes become worn we can change them to the other pair.

7225. *Mr. Fehon.*] But in England, in consequence of the soft wood they use as sleepers there they have to utilise the four fastenings? Yes.

7226. Is not the security of the fastenings an exceedingly important element in the keeping of a safe road for the engines to pass over? Yes; undoubtedly.

7227. The Chief Commissioner stated that the total weight of permanent way employed to the mile of road was a most important element in showing the stability of the line; is that so in your opinion? Yes.

7228. That is, the heavier sleepers make the better road? Yes; and it is most important with regard to durability.

7229. Have you in your possession any facts bearing upon this point? Yes; I have the details of the weights of four different types of permanent way in use upon these railways per mile with me. Shall I quote the weights for each? They are as follows:—

75-lb. D.H. iron Sleepers, 3-ft. centres:—

	lb.	tons cwt. qr. lb.
Rails, 1,760 × 75 lb. × 2	... = 264,000	
Fish-plates (average), 940 × 10½ lb.	... = 9,870	
Fish-bolts, 1,880 × 20½ oz.	... = 2,409	
Chairs and spikes, 3,520 × 29½ lb.	... = 103,840	
Keys, 3,520 × 1½ lb.	... = 37,400	
Sleepers, 1,760 × 252 lb.	... = 443,520	

891,039 = 384 7 3 11

71½-lb. T steel; 8 ft. sleepers; 2 ft. 7½ in. and 2 ft. 8 in. centres:—

	lb.	tons cwt. qr. lb.
Rails, 1,760 × 71½ lb. × 2	... = 251,680	
Fish-plates (average), 940 × 10½ lb.	... = 9,870	
Fish-bolts, 1,880 × 20½ oz.	... = 2,409	
Wood screws, 4,935 × 14¼ oz.	... = 4,395	
Spikes, 3,996 × 14½ oz.	... = 3,621	
Sleepers, 2,000 × 180 lb.	... = 260,003	

631,975 = 282 2 2 15

If laid with sleepers 9 ft. long, 10 in. × 5 in; 2 ft. 7½ in. and 2 ft. 8 in. centres:—

	lb.	tons cwt. qr. lb.
Rails, 1,760 × 71 lb. × 2	... = 251,680	
Fish-plates, 940 × 10½ lb.	... = 9,870	
Fish-bolts, 1,880 × 20½ oz.	... = 2,409	
Wood screws, 4,935 × 14¼ oz.	... = 4,395	
Spikes, 3,996 × 14½ oz.	... = 3,621	
Sleepers, 2,000 × 252 lb.	... = 504,000	

775,975 = 346 8 1 11

80-lb. T steel. Sleepers, 2 ft. 7 in. centres.

	lb.	tons cwt. qr. lb.
Rails, 1,790 × 80 lb. × 2	... = 281,600	
Fish-plates, 704 × 10½ lb.	... = 7,392	
Fish-bolts, 1,408 × 20½ oz.	... = 1,804	
Wood screws, 4,928 × 14¼ oz.	... = 4,389	
Spikes, 4,224 × 14½ oz.	... = 3,828	
Sleepers, 2,112 × 252	... = 532,224	

831,237 = 371 1 3 1

L. and N.W.R., 84-lb. bull-headed steel. Sleepers, 3 ft. centre.

	lb.	tons cwt. qr. lb.
Rails, 1,760 × 84 lb. × 2	... = 295,680	
Fish-plates, 704 × 16½ lb.	... = 11,616	
Fish-bolts, 1,408 × 23½ oz.	... = 2,068	
Chairs, 3,520 × 45 lb.	... = 158,400	
Spikes, 7,040 × 1½ lb.	... = 8,800	
Screws, 7,040 × 1¼ lb.	... = 8,800	
Keys, 3,520 × 1½ lb.	... = 3,740	
Sleepers, 1,760 × 160	... = 281,600	

770,704 = 344 1 1 4

These weights have been gone into very carefully, and, I think, can be taken as accurate.

7230. On the old sections of the line where the sleepers were originally placed 3 ft. centre to centre on the straight, is it a fact that the road in the curves is strengthened? Yes, on curves of from 15 to 30 chains radius they were placed 2 ft. 9 in. apart, centre to centre, and on curves of 15 chains and under they were placed 2 ft. 4½ in. apart, centre to centre.

7231. What is the amount of steel road that the Commissioners have put into the lines since coming into office? About 270 miles laid with 80-lb. and 71½-lb. steel rails.

7232. Do you know the amount of ballast which has been used? Seven hundred thousand tons, I believe.

7233. What was the character of that ballast? Basalt, and diorite, and slag—the very best.

7234. Of an exceedingly hard nature, so that it would last for many years? Yes.

7235. What amount of improvement has been made on the line between Granville and Bathurst since the Commissioners came into office? About 45 miles of road have been relaid, and about 60 miles re-ballasted, and about 81 miles lifted and partially re-ballasted.

7236. Are there still some iron rails on the Western line? Yes, there are; but we hope to get them all out of the main road by the end of the year, and to replace them all by steel.

7237. In relaying, if any rail is taken out, and is still fit for further use, is it utilised? Yes; we use them for sidings mainly, instead of employing new material.

7238. What is the weight of rail in use on the Western line? The weights are 71½-lb. steel, 75-lb. iron and steel, and 80-lb. steel rails.

7239. With your knowledge of the railways of this Colony, are you of opinion that the permanent-way of New South Wales is suitable for the Baldwin engines to run on? Yes; I am.

7240. Certain bridges have been referred to in the course of this inquiry, namely, at Solitary Creek and Wollondilly River, have plans been under consideration for strengthening these bridges, and is the work about to be commenced? Yes; we have already prepared plans for strengthening these bridges, and I would like to show the plans to Professor Warren. [*Witness here produced the plans referred to, and pointed out to the Commissioners the proposed alterations.*] In the Report of the Royal Commission on the Railway Bridges of the Colony issued some years ago it was pointed out that certain of the structures, among them the bridges over Solitary Creek and the Wollondilly were weak, and in consequence of that we are taking steps to strengthen them. This is how we propose to do it: We purpose putting in a centre girder under the existing bridges, and by that means we shall not only strengthen the cross-girders, which are unduly strained, but we shall relieve the main girders, which are also strained above the standard limit. Arrangements are being made for this work to be carried out at once, and in the meantime every precaution is being taken to render these bridges perfectly secure for the traffic.

7241-2. *President.*] You mean, I suppose, by slackening the speed of the trains passing over them? Yes.

7243. *Professor Warren.*] You are not propping the bridge, I suppose? Oh, dear no, I should be very sorry to allow a bridge to fall into such a condition that it would require propping.

7244. *President.*] So I understand that until you have carried out these alterations you slacken speed in going over the bridges? Yes.

7245. And you are going to put the bridge in such a condition that ultimately you will not need to trouble about checking the speed of the trains passing over it? Yes. We do not say that there is any risk now, but we say that the iron is being unduly fatigued, and we think it desirable therefore to strengthen the bridges.

7246. *Professor Warren.*] But you do not mean that by slackening speed you relieve the bridge of stress? Yes, to some extent.

7247. You have taken deflections, I suppose? Yes.

7248. Well, do you find any difference in the deflection between full and slow speed? Yes, with full speed the deflection is rather more than at a low speed.

7249. How much, 10 per cent.? I do not remember exactly but I know that it was rather more in the case under consideration.

7250. Then you suppose that the stress would be proportionate to the strain, but that the slowing down would reduce it a little? Yes. We think it is perfectly safe, but at the same time we believe it desirable to adopt the recommendation of the Royal Commission that I have previously referred to.

7251. After the recommendation of the Royal Commission you say you determined to strengthen them in some way? Yes.

7252. *Mr. Fehon.*] Do you know how long it is since the project of strengthening these bridges was first in contemplation? It was under consideration before the introduction of the Baldwin engines. The matter was looked into, but on account of the pressure of work it was not found possible to carry out until now.

7253. *President.*] What did you say?

7254. *Mr. Fehon.*] I asked how long this work had been in contemplation, and Mr. Foxlee says long before the Baldwin engine was thought of instructions were given with regard to it. [*Plan of Solitary Creek Bridge produced, and the proposed alterations were pointed out by the witness.*]

7255. Pending the strengthening of these bridges being carried out, have proper steps been taken to ensure the safety of the traffic passing over them? Yes, as I have said before, the speed has been lowered and the bridges are carefully inspected.

7256. And although these matters are contemplated, do not you consider that at the present time the bridge has a very large margin indeed on the side of strength as compared with any possibility of risk? Yes; there is a good margin if you took the Board of Trade regulations—that is, 5 tons in tension and 4 compression—it would be quite safe.

7257. And is that your usual practice? Yes, generally.

7258. I am very sorry to hear it.

7259. *Mr. Fehon.*] In that reduced rate of speed would you consider this bridge to be perfectly safe to carry traffic? Yes.

7260. *President.*] What do you mean by factor of safety;—is it the point beyond which it would be unwise to go?

7261. *Witness.*] It is the ratio that the actual strain bears to the ultimate strength, it may be a fourth or a fifth of the ultimate strength, and that we call the factor of safety.

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7262. *Mr. Fehon.*] What is the length of the span on the Solitary Creek Bridge? Sixty feet on the skew.
7263. With two engines coupled together, you would have two engines on together? No; we would only get one engine on and its tender at the same time.
7264. Do you consider that everything necessary has been done for the safe working of the lines, and that the Baldwin engines run with perfect safety on the roads throughout? I do.
7265. And that the road is suitable for the engines in every respect.
7266. *Mr. Hoyle.*] Could you tell me the total mileage of the railways in New South Wales? It is about 2,200 miles.
7267. So that we have about how many miles of rails with less weight of rail than 80 lb. to the yard? We have rather less than 2,000 miles.
7268. With a lighter rail than an 80-lb. rail? Yes.
7269. You have just stated that it is the intention of the department to take out all the iron rails? Yes.
7270. Why take them out if they are perfectly safe as you have stated, you say that the road is good and safe—why take them out until they are worn out? Because it is desirable to do so, inasmuch as they are getting to the end of their life, and inasmuch as we cannot remove all the iron rails by a stroke of the pen, it is necessary to commence before they are actually worn out, in order to have them all removed by the time that they are worn out; in addition to that where you have iron roads with rails wearing out it is necessary to get other rails for repairing purposes, and with that object we are taking out some of the rails that are not actually worn out.
- 7271-2. You say that you are using the 80-lb. steel rail for purposes of economy, how do you reconcile this with the fact that you are taking out a number of rails that are not worn out? Because there is a limit to the life of iron rails, and we cannot wait till they are all worn out before we replace them.
7273. Has that limit been reached? No, not yet, but by the time they are taken out it will have been reached, and there are rails which it is desirable to replace from time to time, and these we are taking out; but if you ask me if the whole of these rails should be taken out now, I say no. We do not, in relaying, use a new rail to replace an old one, but we relay a whole length, and in that way we recover a certain number of rails useful for repairs on portions of a road that we do not intend to relay.
7274. You say that the road is in good order, and perfectly safe, and now you say that you are going to remove all these iron rails; I ask you is it because the limit has been reached to which these iron rails go? There are certain iron rails which it is desirable for us to remove now, and in doing so we must also remove others which are not worn out, because it is not desirable to repair an old road with new rails.
7275. Well, when will the limit be reached? By the time the whole of these rails are taken out the bulk of them will have reached their limit.
7276. I think we must conclude from that that we have unsafe rails on the road? Not at all.
- 7277-8. *President.*] How do you tell when the rails have reached their limit of safety; is there a certain rule by which you are guided? There is no hard-and-fast rule laid down—we tell by inspection. Where they are sufficiently worn to warrant it we remove them.
7279. Then, are there a sufficient number worn to warrant the removal of these rails at once? I do not say that; we have made arrangements for relaying certain portions of the road, and by the time that relaying is completed it will probably be time to remove these rails.
7280. *Mr. Brown.*] We might ask him if the limit of safety will depend upon whether the Commissioners can get the money to take the rails out or not.
7281. *President.*] You say you are going to take out a lot of these rails; is your reason for doing so that the rails have reached their limit of safety; have they reached it, or will they have reached it by the time you mention? They will have.
- 7282-3. What do you mean by that? We are carrying out the change now, and by the time we get to certain sections it will be necessary to take these rails out—that is, calculating at the rate we are going now.
7284. *Mr. Brown.*] In the ordinary course of events, if you had money would you not take many of these rails out? Yes.
7285. *Professor Warren.*] You say it is economical to take them out, because you put in a larger rail? Yes; and because I want the old rails that I take out for use for repairs and sidings.
7286. *Mr. Hoyle.*] Relative to the bridges, you say that nothing has been done to Solitary Creek Bridge, which will answer for the lot, since the report of the Royal Commission was issued; will you give us your reason why this bridge was not strengthened in accordance with the recommendation of the Commission, I understood you to say that the reason was the great quantity of other work that had to be done had delayed this being put in hand, do you not think that work which is in such a condition as to require the slowing-down of an engine passing over it should be gone on with at once? Well, there were many important works to be done, and we took the most important ones first. I know bridges in England over which trains are slowed-down for the same reason that I have stated here.
7287. When was it that you decided to strengthen these bridges? I cannot tell you the exact date, but it was before the introduction of the Baldwin engines.
7288. You are now making arrangements speedily to have this work done? Yes; plans are being got out for the work.
7289. You said that the platforms were altered purely for the purpose of putting them in gauge? Yes.
7290. This [*producing a book*] is the cost-book from Newcastle, showing that the alterations made at certain platforms—I will read them to you:—June 25th, 1891, D.E. 91-1,048, E.E. 91, Hamilton to 51 North Coast—altering platform to give clearance for new locomotives:—Date of completion, 14th September, 1891; wages, £45 16s. 11d. And again—June 25th, 1891, D.E. 91-1,048, Newcastle to Warran-garra—altering platform to give clearance for new locomotives:—Completed, 14th September, 1891; wages, £1,092 3s. 2d.; stores, £378 3s. 8d. And again—June 25th, 1891, D.E. 91-1,048, Newcastle and Wallerawang—slewing roads to give clearance for new locomotives—Completed 14th September, 1891; wages, £47 9s. 2d.; stores, £2 8s. 7d. Can you explain these entries? I explain as I have before explained, that since the Commissioners took office, instructions were given to ascertain to what extent the platforms on the lines were out of gauge, and that being done, directions were issued to bring them to Mr. Whitton's standard gauge, and the platforms to which you have referred are portions of the structures which were so brought to gauge; the advent of the Baldwin engines undoubtedly accelerated these alterations; I have nothing to do with the way they were entered in the book.

7291. *President.*] Who entered them? The Divisional Engineer would probably be the person.

7292. *Mr. Hoyle.*] I notice that in this book the Engineer-in-Chief's minute of 1891 is quoted, and I presume that would be done from your instructions from the Head office? No doubt it would be done from instructions received from the head office.

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7293. Will you produce that minute? Yes; I will have it produced.

7294. Now, if this work was only done to bring the platforms into gauge, why did you charge it in the way I have stated;—why did you not charge it under the head of bringing the road to gauge, and not to the Baldwin engines? That is a matter that rests with the Divisional Engineer;—the object was to enable the Baldwin engines and other engines of similar dimensions to run over the line without let or hindrance.

7295. The Divisional Engineer stated that nothing had been done since January, 1891, and any alterations that had been made had nothing to do with the Baldwin engines, but here we see that the work was charged directly to those engines.

7296. *Mr. Brown.*] You can recall the witness, Mr. Hoyle, but you cannot connect Mr. Foxlee with that statement. I do not see how you can make this witness responsible for another person's statement.

7297. *Professor Warren.*] Have you got the minute referred to by Mr. Hoyle? No; I have not got it.

7298. *Mr. Hoyle.*] The number of the minute is 1,043, 1891.

7299. *Mr. Brown.*] You will produce that minute, Mr. Fehon?

7300. *Mr. Hoyle.*] Some considerable alterations were made at the Eveleigh coal-stage;—were those alterations made in order to give clearance to the cab of the Baldwin engines or not? Yes; the Baldwin engines and other engines of similar dimensions.

7301. Is it not a fact that the Baldwin engine could not have got to the coal stage if these alterations had not been made? Yes; nor could any other engine of similar dimensions have done so.

7302. Then how did you coal the other engines, which you say were wider? I cannot answer that question. You had better ask the Chief Mechanical Engineer.

7303. I would like to recall Mr. Robinson, of the Locomotive Department, for the same reason that I wish to recall Mr. Halligan, namely, that he has given very contradictory evidence—his report to the department is contrary to the evidence which he has given.

7304. *President.*] Very well, he will be recalled.

7305. *Mr. Hoyle.*] Will you tell us when the alterations to the coal stage at Eveleigh were made? I think some time last year; but I am not quite certain.

7306. Have you any experience of the spacing of sleepers in England? Yes.

7307. Can you tell us of any railway where the spacing of sleepers is greater than 3 feet—(say) 3 ft. 1 in.? Speaking generally, the spacing is about 3 feet, but I cannot say accurately. Speaking generally, what I have said represents the fact.

7308. You know the rail on the Great Western line, the 62 lb.—a bridge rail—is that on a longitudinal sleeper or not? A bridge rail is, of course, on longitudinal sleepers. The new rails they are putting down are double-headed.

7309. What is their weight? I am not quite sure; but I think it is less than 80 lb. per yard. However, I am not certain.

7310. But a 62-lb. bridge rail used on the Great Western line is, you say, carried on longitudinal sleepers? Yes.

7311. Would a bridge rail supported in that way be as strong, and carry as great a weight, and be as solid as an 80-lb. rail with sleepers spaced 3 feet apart? I do not think so.

7312. Why? Because a light rail is more flexible, and, despite your timber, it would have a tendency to bend with the weight passing over it. The heavier your rail the more rigid it is.

7313. I have the authority of Mr. Findlay, the manager of the Great Western, for saying that a longitudinal sleeper is about equal to 10 lb. on the rail.

7314. *Professor Warren.*] But Mr. Findlay is not an engineer.

7315. *Mr. Hoyle.*] I shall put in evidence to-morrow to show that English railways have their sleepers more closely spaced. (To Witness.) How was the Glenlee Bridge tested;—what was the weight on the bridge when the test was made? A Baldwin consolidation engine.

7316. Only one engine? Yes; and, I think, two cars.

7317. *Professor Warren.*] You put the heaviest load you could on, and I suppose that was a Baldwin engine? Yes.

7318. The 62-lb. rail was used by the Great Western Railway Company was carried on longitudinal sleepers, was it not? The bridge rail was.

7319. Would not the bridge rail, carried on longitudinal sleepers, be as strong and carry as great a weight as an 80-lb. rail with sleepers placed 3 feet apart? I do not think so.

7320. Can you say why? Because the lighter rail is more flexible than the heavier rail, and, in spite of your timber, the thing would bend with the weight passing over it. The heavier the rail the more rigid it is.

7321. I have not the authority with me, but I have it at home, and can bring it to-morrow; but Mr. Finlay, of the London and North-Western Railway Company, states that the longitudinal sleeper adds strength equal to about 10 per cent. of the rail.

7322. *Professor Warren.*] Mr. Findlay is not an engineer.

7323. *Mr. Hoyle.*] No; but he makes the statement upon the authority of Mr. Thornhill, who has calculated the thing out.

7324. *Professor Warren.*] Well, he is an engineer.

7325. *Mr. Hoyle (to Witness).*] Will you tell us how the Glenlee Bridge was tested;—what was the weight on the bridge when the tests were made? A Baldwin consolidation engine was run on to the bridge for the purpose of making the test.

7326. Only one engine? One engine and, I think, two cars.

7327. But is it not customary when testing bridges to put a greater weight upon them than the weight that they are likely to have to carry? Yes; but it is not intended to couple two Baldwin engines together in any portion of these roads, so that no bridge is likely to have to carry them, and in the case of the Glenlee Bridge only the engine could rest upon an opening at one time.

7328. Yes; but when you are taking a test of a bridge of that kind you would usually have more than two carriages, would you not;—is it not customary when testing a bridge to put a live and dead load upon it? It is customary to put the heaviest rolling load upon it.

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7329. Well, then, inasmuch as that was not done in this case, do you consider that the test was a fair one? We put the heaviest load upon the span that it could possibly have to carry, and that is a Baldwin consolidation engine.

7330. What is the length of the span? Twenty-one feet.

7331. What is the factor of safety allowed by you for the dead load on your bridges? We took the whole thing together in the Glenlee Bridge, and we made a factor of safety at about 7.

7332. And do you consider that a factor of safety of 7 for a live and a dead load is perfectly safe? Yes; I do.

7333. Is that the same for iron bridges? It is lower for iron bridges.

7334. What would be your factor of safety in the case of iron bridges? Four or 5.

7335. I see Professor Rankin states here that in timber bridges the dead load should be from 4 to 5, and the live load from 8 to 10;—do you consider that a factor of safety of from 8 to 10 for a live load is excessive? I told you what our usual practice is with timber such as we have in this country, and that I consider sufficient.

7336. Do you know what is the custom in the railroads of America—Mr. Eddy stated in his evidence the other day that some of the trains run from 50 to 70 miles an hour over a 67-lb. steel rail;—do you know what the spacing of the sleepers is in that case? I am not very well acquainted with the railways of America.

7337. *Mr. Fehon.*] It will, perhaps, be as well if Mr. Hoyle, in the first place, asks Mr. Foxlee if he has been in America.

7338. *Witness.*] No; I have not.

7339. *Mr. Hoyle.*] Well, Mr. Eddy in the course of his evidence stated a great many facts in regard to American railways, but I might as well have asked him if he had ever been in America.

7340. *Mr. Fehon.*] Oh, yes; he has been in America.

7341. *Mr. Hoyle.*] Well, he has never been on the line that I am alluding to.

7342. *Professor Warren.*] Mr. Eddy will probably give evidence again, and you will then have an opportunity of asking him these questions.

7343. *Mr. Hoyle (to Witness).*] Do you not consider, taking a 71-lb. rail for example, that sleepers placed at 2 feet 9 inches apart, would make the rail infinitely stronger than a rail of the same weight with sleepers placed 3 feet 1 inch apart would be? Oh, yes; I daresay it would.

7344. Can you tell us what is the difference in strength between iron and steel in rails? You may take 50 per cent. in the case of steel over iron.

7345. That is to say that steel is half as strong again as iron? I should say so, taking it roundly.

7346. *Professor Warren.*] You have spent considerable sums of money in relaying various parts of the road with 80-lb. rails? We have.

7347. Do you think that the spacing of 1 foot 8 inches in the joint will be sufficient to prevent the joints going down, as a result of the pressure of the driving-wheel? You have to take into consideration the length of the fish-plate.

7348. Yes, but your fish-plate is a common fish-plate? Yes.

7349. Well, if you look at this sketch you will see an angle fish-plate, which I daresay you are familiar with. Is it not customary on the English railways to use angle fish-plates? Speaking generally, English rails are double-headed rails.

7350. Yes; but even on a double-headed rail, is it not the custom to use angle fish-plates? Fish-plates, with a lip to them.

7351. We will take a T rail for example. Is it not customary in America to use angle fish-plates with T rails? They have angle fish-plates on some of the roads there, I believe.

7352. Take the London and North-western Railway, in England, for example. You have a double-headed or a bull-headed rail there, but they are not content with the common fish-plate—they want something stronger? A large proportion of the roads in England are laid with a fish-plate which do not pass under the rails, but as the North Western Company are relaying their main road, they are, I believe, putting in fish-plates that have clips.

7353. Well, do you not think that you ought to have done so here? No; I do not think so. We find the spacing of our sleepers at the joints gives a sufficiently rigid road.

7354. You think that the joints, as the lines are laid at present, are as strong as the rest of the rails, do you? I think they are sufficiently strong. I may say that we have had the angle fish-plate before us, and are making experiments with it, and if we see that any advantage is to be gained by using them, I have no doubt that the Commissioners will take into consideration the advisability of adopting them generally.

7355. You think that the common fish-plate is good enough, however, with your present spacing of the sleepers? We think so.

7356. When you spoke of the spacing of the road, it was merely with regard to the assumption that the joints are well designed? We find that it is necessary to have a certain dead weight in the road to resist the shock of passing trains.

7357. What was the dead weight in this case? Three hundred and eighty-four tons 7 cwt. 3 qrs. and 11 lb. per mile, in the case of the 75 double-headed iron rails with sleepers 3 feet apart centres.

7358. In another case about 382 tons per mile, and in another 346 tons? Yes; we find that the heavier the road the easier it is to keep it in order, as far as line and level are concerned.

7359. But what do you think, yourself, about the angle fish-plate;—do you think that it would be a very desirable thing to put in? We are experimenting with it, but I certainly have not come across an angle fish-plate for a T rail that I should feel any confidence in asking the Commissioners to adopt at present.

7360. Do you drill holes in the flanges of the rails? It has been the practice to some extent.

7361. Do you consider it good practice? It has the effect of keeping the rails from creeping.

7362. Could you not arrange an angle fish-plate that would have the same effect? I have not seen it done satisfactorily with an angle fish-plate. All sorts of contrivances are adopted for the purpose of preventing the rails from creeping. I have seen an arrangement by which deep fish-plates are used, and which extend below the tops of the sleepers.

7363. Do you not think it is a bad thing to bore holes through the flange of a rail? Well, if you cut it out at the end where it rests upon the sleeper I do not think it would matter much. If it is near the end of the rail I do not think there is any great objection to it.

7364. One more question upon rails, I merely want to take your opinion, do you consider that treating a rail as a fixed beam or a continuous beam is correct? In the evidence that I gave —

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7365. Yes, but since then we have had other evidence, and I want your opinion upon that point? I think that any calculations you make one way or another are of very little practical use.

7366. In fact you think that you cannot represent by calculation what actually takes place? No, because there are so many buts and ifs about it all.

7367. *Mr. Hoyle.*] Well, now bearing in mind the factor of safety recommended by Mr. Rankin, would you say that the same factor of safety should be maintained in ironbark as in Baltic timbers? Oh, no.

7368. Professor Rankin can hardly be including ironbark in his calculations, I should think? I do not think so.

7369. He certainly does not refer to it specifically. I do not see it included amongst the timbers given in the list, upon which he bases his calculations? And I do not think he can have had it in his mind when he recommended such a high factor of safety.

7370. In ironbark would you not consider a factor of safety of four would be sufficient, providing of course that the wood is in good condition? Yes; I should.

7371. I mean of course a real factor of safety of four, not a factor of safety of four at some distant period in the past? Yes.

7372. I will not say anything about the Glenlee Bridge, except to ask you about the tests you said you have made, were those tests made with a Baldwin engine and the driving-wheels in the centre of the bridge? Yes; the engine was placed in the very worst position in which it could be put.

7373. And you got how much deflection? Five-sixteenths of an inch I think.

7374. *Professor Warren.*] That is very small indeed. It is no use for me to say anything more about the matter, except this; Mr. Hoyle referred to the testing of the bridge with an engine and two carriages? That has nothing at all to do with it, we put the heaviest portion of the load on one span.

7375. I was going to say would it not affect the brake test? Of course, if you have a long train and after running it on to the bridge apply the Westinghouse brake, you produce longitudinal stress? Yes; that is precisely what is done, the train was taken on to the bridge at a high rate of speed and the brakes were then applied, the result being, I believe, that the longitudinal stress was nil.

7376. If you had had a longer train you would have tended to produce a greater stress, I take it, of course you had a small train with a heavy engine attached to it? Well, the effect was nil, possibly there might have been a greater effect with a longer train.

7377. You stated just now that you adopted the Board of Trade rules—5 tons in tension and 4 tons in compression for iron bridges. Are not the Board of Trade rules considered to be obsolete? Well, I have heard some people say that they are getting behind the age, but they are almost universally followed in England, in bridges of moderate dimensions.

7378. Yes, but take the deck of a bridge in England, would it not be much heavier than the deck of a bridge here? They are not heavier than the decks of bridges that we have been building recently. We have adopted the English practice.

7379. That would be in the quadruplication work I suppose? Yes; and in the duplication of the Southern line.

7380. But if you were building a bridge in the country you would not use brick arches, would you? Yes; if I could afford it I certainly would use brick or masonry arches.

7381. *Mr. Brown.*] Then after all the amount of money you have to spend determines the factor of safety? No; it is not so much a question of the factor of safety that I am thinking about as the desirability of avoiding frequent repairs.

7382. *Professor Warren.*] The Petersham viaduct is laid with what I believe you call an American deck? The old Petersham viaduct is, but not the new one.

7383. The deck of that bridge would weigh much heavier than an American deck? It would weigh much heavier no doubt.

7384. But take this bridge as you have designed it (referring to the new portion for the quadruplication) the ratio of the dead load to the live load that it carries is very small compared to your brick arches. Would you not allow a larger factor of safety in the case of a bridge like this than you would in the case of a bridge with a heavier deck? You can hardly compare an iron bridge like this with a brick bridge.

7385. No; but I want to get at is the factor of safety, and I want to hear what you would say about the factor of safety, if you have a smaller dead load to the same live load. There are some bridges between Parramatta and Penrith with lattice girders. The dead load is say one, and the live load nine, would you allow 4 or 5 tons there? Where the structure is proportionately so much lighter than the load that it has to carry, I should certainly be inclined to put a little more metal into the girders.

7386. But in certain parts of these bridges between Parramatta and Penrith, which are not so very new, what working stress would you allow? You could not bring those little light bridges down to the standard of four or five, or probably three. You could not reduce your metal sufficiently to bring them down to the theoretical strength.

7387. You would allow a smaller working stress? Yes; that is what it amounts to, and that applies generally to lattice girders of small dimensions.

7388. Can you give me the dead load per foot run on this bridge? I can supply you with the figures.

7389. At all events you have provided for the Baldwin engines on this bridge? Yes.

7390. Did you reduce it to so many tons per foot run? No; we never do that. We loaded it as badly as we could, shifting the engines about, so that they would produce the worst possible effect upon the bridge. I never take the rolling load at per foot run. I put the heaviest engines I can get in the worst possible position, and having done that, find the resulting stress and provide metal accordingly.

7391. Can you tell me whether that is the best American practice also? I am not sure; but I think it is a very proper one.

7392. Did you take more than one engine on the bridge? Yes; in this case we filled the spans with American engines. We put four or five on the bridge, and then got the resultant stress, not because they would ever run over the bridge four or five at a time, but because we determined to provide for the greatest possible stress.

7393. And you have done that on all the bridges that you have designed? Yes.

7394. Well, that simplifies that matter very much, and shows that you have taken due precautions? That is, I think, the proper thing to do.

7395.

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7395. If they had done that in the case of the Solitary Creek bridges, there would not have been so much trouble with them? No.
7396. You prepared a list of the bridges for the Commission, did you not? Yes.
7397. Will you tell me first of all, with regard to the Solitary Creek Bridge, what is your maximum stress? Do you mean what will be the maximum stress when the Baldwin engines are on the bridge and when it has been strengthened?
7398. No; as it is now. We see that you are going to strengthen the bridges, and we are very glad of it? The maximum stress is 5 tons in compression, and 7·24 per square inch in tension.
7399. Did you do that in exactly the same way as you took the stresses on the other bridges, by placing the Baldwin engines in the worst possible position? Yes. I have a diagram prepared specially, showing the stresses. I have had a second diagram prepared also. I am not sure whether it varies slightly from the first or not; but practically these are the stress [*pointing to the diagram*]. The working drawings have been prepared. I think the figures are the same as those I have given you.
- 7399½. The dead load on the bridge has not been altered since the Royal Commission on Bridges sent in their report, and it is given as 726 tons per foot run; the total load is given as 2,726 tons per foot run. The ratio of the dead load to the dead load plus the live load is ·27. Assuming that the stress may vary from ·27 to 1, what would be the breaking strength of the material—supposing you take a piece of iron in tension, what would be its breaking strength? I am afraid I do not quite follow you.
7400. I want to get the real factor of safety, and I want to find out what would be the breaking strength of the iron in the Solitary Creek bridges if they were loaded and relieved just as they are, in point of fact, by the trains running over them? I get a factor of safety of four. In strengthening the bridges I shall take care that the factor of safety is not below four.
7401. Well then, assuming that you put a girder in, that would be as strong as the two girders that are in at present, your factor of safety at the present time would be about two, would it not? What I say is that the range of stress is ·27. If the breaking strength is 21 tons, when the load is gradually applied, and you apply loads which vary from, say, 2 tons to 8 tons, and then again from 2 tons to 8 tons and so on, which you really do when you run a train over them, what would then be the breaking strength of the bridges it would be very much less than 20 would it not? Yes.
7402. Supposing it was 15 or 16 tons, and you gave 7·24 tons? I see what you are driving at.
7403. Yes; in that case where is your factor of safety? That would bring the factor of safety down to about two, assuming, of course, that your calculations are correct.
7404. Well, you can prove them for yourself; they are not mere calculations, they are facts proved by experiment. Do you consider that merely slowing down a train is good enough on a bridge that only has a factor of safety of two? I certainly think it is desirable to have a greater factor of safety.
7405. Yes, you would like to have a factor of safety of four? Oh, I certainly should in putting up a new bridge. I should never think of giving a smaller factor of safety.
7406. Do you think for a moment that putting the Baldwin engines quietly on the bridge would produce half the stress that would be produced by them if you were running them over it at the rate of 50 miles an hour? It would undoubtedly produce half the stress.
7407. It would produce more than half the stress, would it not? I am looking at the deflections actually taken in regard to the Wollondilly Bridge, and also upon some of the Solitary Creek bridges.
7408. Can you tell me what is the difference between your live load deflection and your dead load deflection? I have generally found that the effect of a train rushing over a bridge is greater than one standing upon the same bridge.
7409. I want to know how much greater? There is a difference, but I cannot give you any rule, because it varies in almost every case.
7410. All I want to know is what it would be in the case of the Solitary Creek Bridge? I do not know what it is; I only know that it varies, or that it did vary.
7411. Well, then, I must fall back on the report of the Royal Commission on railway bridges, in the case of Barber's Bridge, which is similar to the Solitary Creek Bridge in construction; the span is 60 feet, and a standing train produced a deflection of ·5, and the running train produced a deflection of ·56, so that the difference would only be about 12½ per cent., or say 15 per cent., between the train standing on the bridge and the train running over it? Yes.
7412. Well then, looking at the facts of the case, do you think that these bridges are safe, and that all precautions are being taken? Yes, considering that we are preparing to strengthen them.
7413. You believe then, or I should say do you believe, that these bridges are weak? They have not the same factor of safety that they would have if we were building new ones.
7414. That is to say, you feel rather nervous about them? No, I certainly do not feel nervous about them; but I say that if we were building new bridges, we should build them stronger.
7415. And you say that there is a factor of safety of two? Well, you tell me that there is. If your calculations are correct there is, and I do not want to dispute them.
7416. Well, you have taken your factor of safety on 21 tons, which is not the breaking strength of the iron in the Solitary Creek bridges, considering that the load varies from 0·76 tons to about 2·76 tons? You have stated there is a factor of safety of two, and now you are asking me to verify your figures. Probably you are right, but I would like to have an opportunity of looking over my figures again.
7417. But it would have been better if you had come here with your figures, Mr. Foxlee? I did not know that you were going to question me exactly on the lines that you have been questioning me upon. I have brought my diagram here, which shows that the iron is unduly strained. These are my calculations, and we are taking steps to remedy the defects in these old bridges.
7418. Well, I ask you then what factor of safety have you in the Solitary Creek bridges? A factor of safety of about three.
7419. How do you find that factor of safety? By taking the ultimate strength of the iron at 21 tons per square inch.
7420. Therefore, you make no allowance for the fact that there is a range of stress? I have made no allowance whatever.
7421. And that is your factor of safety? That is my factor of safety.
7422. Are you aware that experiments have been made in Germany and also by Sir Ben. Baker and others showing clearly that the strength varies entirely by the way in which the stress is applied—supposing that

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that the tensile strength is 21 tons per square inch, and you apply a tension of 8 tons per square inch, and that test varies from tension to an equal compression.

7423. I want to get at this factor of safety;—I want to see how you arrive at your conclusions—it is very important, because if one man takes it one way, and another man takes it another way, we shall have all sorts of standards with regard to the factor of safety, and the consequence will be that some engineers would give two as the factor of safety where you are giving three—each meaning quite a different thing—it is very important that we should know really what is meant? Yes.

7424. What I say is this: a piece of iron is put in the testing machine, and you pull it gradually, and it breaks with a pull of 21 tons per square inch; but suppose you supplied a stress and then relieve it entirely, and applied it again, and continued relieving it, and applying it say 5,000,000 times, what is the effect? The effect is to fatigue the metal of course.

7425. What will be the ultimate breaking strength, if the statical load is 21 tons? I take it that ultimately the iron will fail.

7426. With how much? I am not at this moment prepared to say.

7427. Would it not break at about 14 tons? Possibly.

7428. Well, then supposing you applied the stress in that way by compression, and an equal tension alternately, what would be its breaking strength? I am not prepared to answer that question, in a small bridge of this character, I do not consider that it makes a very material difference.

7429. But the stress varies considerably between a live and a dead load according to your own figures. This bridge carries its own weight, and if a Baldwin engine passes over it it carries the Baldwin engine as well. The ratio between the bridge loaded and unloaded is very considerable? Yes, undoubtedly.

7430. It would be about .27 would it not? Yes; I think so.

7431. So there is great difference between the range of stress, and I want you to show what the difference is, taking it in conjunction with the experiments made? I have not gone into that beyond taking the stress resulting from the worst possible load that we could put upon the bridge. We put the worst possible load on the bridge, and we take the resultant in stress.

7432. And have you made these calculations? Yes.

7433. Can you give any idea what the strength would be after a certain number of applications of the test? I have not gone into that.

7434. It gets those applications, no doubt, when a train passes over it? Yes.

7435. It is a very important matter? We shall get these and other tests of the strength of the viaduct when we put the work in hand.

7436. I take it that you are going to do the same thing with the Wollondilly bridges? Yes; they are exactly similar.

7437. Have you noticed some difference in the joints? No; I have not had detailed drawings before me; but the main girders, and also the cross girders are precisely similar to those on the Solitary Creek bridges, and we propose to deal with them in the same way.

7438. That is to say, you will make each additional girder about as strong as the two present girders in each span? Theoretically, I think it takes about two thirds of the load, but we shall make it strong enough to carry the whole load.

7439. In the list of bridges supplied you give the spans and the actual working stresses; I take it that these working stresses are due to Baldwin engines passing over the bridges? Yes.

7440. You do not record the deflections, though they were asked for? I believe we have the results in the office.

7441. You say on your own paper here that they were asked for? If they are not here we shall let you have them. I asked that the deflections and the loads producing them should be recorded.

7442. So that I cannot ask you any questions upon these bridges? I am sorry that they have not been supplied, but I will take care that you have them.

7443. What span has the Petersham viaduct; I do not see it amongst these calculations? Yes; I think it is included in the calculations you have before you. Each span is 87 ft. 9½ in.

7444. Well, you have given me the working stress at 4 tons on the top, and 4.93 tons—practically 5 tons—at the bottom? Yes.

7445-6. That is a case in which I think there is some variation; you have not given me the load here? That is arrived at in the same way, by putting a Baldwin engine on the bridge.

7447. The weight of those bridges, referring to Rochester Creek and Duck Creek Bridges, would be very slight compared with the load they carry, would it not? Well, the floors are rather heavy. They are cross troughs; all iron, and consequently heavier than the other system of flooring.

7448. Well, the highest stress is only 5 tons? Yes.

7449. We have a series of plans of 21 feet.

7450. Are they designed in the same manner as on the Glenlee Bridge?

7451. Are they of iron? No; they are timber.

7452. Is that your standard bridge; that is what I want to get at? Yes.

7453. So that, whatever the Glenlee Bridge is in strength, these are as strong as this is? Yes.

7454. You have here a factor of safety of 7.5? Yes.

7455. There is a bridge at 37 miles 75 chains; is that stronger than the Glenlee Bridge? It is the Glenlee bridge.

7456. Well, these carry the Baldwin engines, I take it? Yes.

7457. So that, assuming your calculations to be right—assuming the Glenlee Bridge to be correctly worked out—these bridges must be weaker in proportion by 9.77 to 7.5? Yes.

7458. I suppose there is no doubt about the factor of safety. They show really what has been done? Yes.

7459. I suppose we can see these viaducts on our way up the line? Certainly.

7460. Are they new viaducts? They are old bridges widened.

7461. You have adopted the same system of construction, I take it, in the other bridges and in Glenlee Bridge? In some cases we put the longitudinal timber immediately over a pair of girders instead of on one side and that accounts for the variation in the factor of safety.

7462. Do you propose to do anything to the Penrith Bridge? There are two or three recommendations by the Royal Commission on Railway Bridges, one of them is that when the line is duplicated the weight should be distributed over the cross-girders, but we are not duplicating the line at the present time, so we are leaving it.

7463.

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7463. We ought to have a few of these bridges cleared up. The Glenlee Bridge we shall look to; the Solitary Creek Bridge you are going to strengthen, and the Wollondilly Bridge you are going to treat in the same way. And the Baldwin engines are not running over it?

7464. *President.*] Do the engines purchased from Beyer and Peacock run over it;—they are heavier than the Baldwin engines, are they not? No; they are rather lighter.

7465. *Mr. Brown.*] But you must remember that they have a rigid wheel base, and that makes a difference.

7466. *President.*] You say that you think the Solitary Creek Bridge is perfectly safe for the engines? Yes.

7467. I mean to say, going over it day after day as they do, is it perfectly safe for them? I think it is perfectly safe, but it is also desirable to strengthen it as soon as possible, because we are straining the iron beyond the limit to which it should be strained.

7468. *Professor Warren.*] You are not responsible for that bridge—not for the design of it, I mean? Oh, no.

7469. *President.*] But I am thinking of the public—as far as the public are concerned, need they feel at all anxious about it? Oh, no; the public have no occasion to feel alarmed about it.

7470. *Mr. Fehon.*] Are not rails always removed long before the limit of safety is reached? Undoubtedly.

7471. In fact, no works are left until the limit of safety has been reached? Oh, no, certainly not; we do not wait until they reach their breaking point before we renew them. We have to commence our work of renewal before the ultimate strength is reached.

7472. You are aware that the first Baldwin engine that arrived here—I mean those that arrived some years ago—are running on the western road? Yes.

7473. And the platforms were altered to meet their case? I understand that they were.

7474. And that when the new Baldwin engines were ordered it was thought necessary to push on the work of alteration to the platforms along the Northern line and also on the Southern lines? Yes.

7475. So that this work of making the platforms uniform should be completed, and the roads made available for the running of any engines—the new Baldwin engines and any others that might be required to run over the length and breadth of our railways? That is so.

7476. There has been a great deal of talk about the Glenlee Bridge? Yes.

7477. The Glenlee Bridge is a duplicate bridge, is it not? Yes.

7478. Is not the new bridge much stronger than the old one that has carried the traffic for so many years? It is one of the finest wooden bridges that we have on the line, in my opinion.

7479. *Professor Warren.*] You designed it, did you not? Yes.

7480. *Mr. Fehon.*] The strengthening of the Wollondilly and Solitary Creek Bridges was decided upon by the report of the Commission on Railway Bridges, was it not, and the Baldwin engines had nothing to do with it? I believe that is so.

7481. And the Scotch-Yankee engines, which are very nearly as heavy as the Baldwin engines, used to run over those bridges without any slowing-down business, did not they? Yes.

7482. That is a fact that is worth a good deal of theory.

7483. *Professor Warren.*] Yes; but there have been a good many bridge accidents in various parts of world, Mr. Fehon.

7484. *Mr. Hoyle (to Witness).*] Do you consider that two engines coupled together do the road more injury than one engine? From the reports that I have had from my inspectors and divisional engineers, I learn that it is so.

7485. Yes, but I am asking for information within your own personal knowledge. You are an engineer, Mr. Foxlee, and one who holds a very high position in this country, and has held high positions in England, I want your own opinion? It is my opinion that two engines coupled together would be more injurious than one engine.

7486. It has been stated that the Baldwin engine, because of its flangeless wheel, should be less destructive to the road than some lighter engines that had been previously employed, they having flanges on all their wheels, but, as a matter of fact, the Scotch-Yankee, which is a lighter engine than the Baldwin engine, have also a flangeless wheel? Speaking generally, two engines coupled together do more harm to the road than a single engine working over it.

7487. Yes, but will you explain why they do more harm to the road? I am hardly able to tell you; but, as a matter of fact, it is known that they do.

7488. Is it a matter of fact or a matter of theory? A matter of fact. If you talk to any platelayer on the road he will tell you that it is so.

7489. Yes, but we have had evidence on the question from platelayers themselves, only the other day we had four witnesses, all of whom were platelayers, called here to bear out this statement made by the Chief Commissioner, and each of them said that in his opinion two engines did not do more harm than one engine, so that is why I ask you whether it is not a matter of theory more than a question of actual practice? Well, if you get an individual witness here, he will give you his opinion, and it may vary from the statement that I have just made; but I am able to judge from the collective testimony of these men, and that leads me to believe that two engines coupled together do more harm than a single engine.

7490. Well, in the instance that I have referred to, six witnesses were called to prove that two engines when coupled together, did more harm to the road than one engine, although it might be a heavier engine, and when questioned by me on the matter, four out of the six gave the opinion that one engine was just as damaging to the road as the two engines coupled together; but, however, I accept your evidence on that matter. Now, relative to this Glenlee Bridge, Mr. Fehon has asked you about the old bridge, which, for many years, has been carrying heavy trains. Is it a fact that an engine of such great weight as a Baldwin engine has been running over the old bridge? I think it has had about the same load to carry as the new bridge.

7491. It is on the express road, and it is therefore a road over which the train travels very fast;—would not an engine weighing, say, 4 tons more, have a more damaging effect upon the bridges than a lighter engine? Of course the heavier the load the greater is the effect; but there would not be any appreciable difference in the effect produced by an engine weighing 4 tons more or less than another.

7492. Has any strengthening been done to the Glenlee Bridge since it was built? Do you refer to the new or to the old bridge?

7493. To the new one. Has anything been done since it was originally built by you? Nothing whatever.
 7494. Mr. Haycroft has written a letter to the Commission, and it has been placed in my hands since I came into the room this afternoon. He wishes to be recalled for the purpose of explaining something in his evidence, or rather, I think, to contradict something stated by Mr. Eddy. He says that the cutting on the margin of the letter is from the *Daily Telegraph*. The cutting to which he refers reads as follows:—

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 W. T. Foxlee.
 25 May, 1892.

Incorrect "Expert" Evidence.

"As I am on the Great Western Railway, and as you have had so-called 'expert evidence' called to speak of the weight of the rails on the Great Western Railway seven years ago, and which I know of my own personal knowledge to be absolutely wrong, I think I might give you a statement made by Mr. Wolfe Barry, who is an eminent engineer at home. The expert before you said nothing about the bearings, but referred only to the weight of the rails. The universal practice with cross-sleepers in England is to have them 3 feet apart. It is a most exceptional thing to have them less. Mr. Wolfe Barry says, 1890 edition:—

"Thus, on the Great Western Railway, a rail weighing 62 lb. per lineal yard has carried for many years, and is now carrying the heaviest traffic, while other companies, and the Great Western Railway Company itself, is using cross-sleepers for a rail weighing from 75 lb. to 80 lb. per yard."

"I do think that it is wrong for these witnesses who have been 'studying it,' as they say, to come here and make statements of that sort. I will give you information received from Sir John Fowler two days ago. He is consulting-engineer to the Great Western Railway. It is most wrong that the credit of the Commissioners should be attempted to be broken down without any knowledge of the facts. It is proposed to relay the Didcot to Bristol section of the Great Western Railway, with the narrow instead of the broad gauge. Sir John Fowler was asked to state by cable the weight of the rails proposed to be used. He says:—

"Quantity of 85-lb. rails very small. Nearly whole length is 68 lb. flat-bottom bridge rails."

In his letter Mr. Haycroft says:—"Trusting I am not committing a breach of etiquette, legal or otherwise, I have the honour to address you as follows:—The cutting on margin is from *Daily Telegraph*, May 19th, and purports to be copy of part of evidence given by Mr. Eddy before the Commission; as Mr. Eddy's remarks refer to my evidence as an expert, I hope you will give me the opportunity of traversing his statements. Mr. Eddy, with the object of proving my statement, that 86-lb. steel rails were in use on the Great Western Railway seven years ago, to be correct, has stated, to his own knowledge, my evidence is absolutely wrong, and in support of his own evidence quotes from railway appliances, by John Wolfe Barry, whom he styles "an eminent engineer at home," the edition from which he quotes being, as he states, 1890. In reply thereto I have just to state that in the 3rd edition of Mr. Barry's book, dated 1881, or close on eleven years ago, exactly the same statement, as quoted by Mr. Eddy, appears, thus proving that Mr. Barry, eminent engineer though he undoubtedly is, has not kept his several editions up to date. In support of my statement, which was made from actual observation about seven years ago, I beg to refer you for corroborative evidence to Vol. 20, 9th Edition of the *Encyclopædia Britannica*, page 243, published in 1886, in which will be found a full description of the 86-lb. steel rail in use on the Great Western Railway at that time, also the peculiarities of the chair used in connection with said rail.

"The value of the information imparted by the E. B. on this subject is due to the fact that the statistics were compiled by, amongst others, such men as Daniel Kinnear Clarke, M.I.C.E., a well-known authority on railway matters, and Mr. A. M. Wellington, M.A.M. Soc. C.E., referred to by Mr. Eddy as having published a standard work on railways, and therefore a reliable authority.

"Weight of rails—strength and durability.

"Wellington's work, 'Railway Location,' is one of the standard works on railways, and from the extracts given below it will be seen that in America 70 lb. per yard for steel rails was evidently the highest standard, but that for reasons of economy an 80-lb. rail was urged, and it was thought would doubtless be adopted ultimately."

As I do not wish to lie under the stigma of having wilfully given evidence which Mr. Eddy calls absolutely wrong, I hope you will give me the opportunity of rebutting such a statement in as public a manner as the statement was made."

Well, I do not know when this is to end. I am quite willing that Mr. Haycroft, if he feels aggrieved, should have an opportunity of contradicting anything that has been said by Mr. Eddy, but this Commission cannot be eternal. At the end of this week my attendance at it I fancy will be very infrequent, whilst I have a duty to perform to the public as its President, I have also a duty to perform to myself, and I cannot allow it to interfere entirely with the course of my own work. At the same time, if Mr. Haycroft wishes to give any further evidence, he can be recalled.

7495. *Mr. Brown.*] As far as I am concerned, I do not see why he should be recalled, the thing will be interminable.

7496. *President.*] The matter upon which Mr. Haycroft desires to be recalled is not one that would suggest itself to my mind, or to the mind of my colleague, Mr. Brown, I think, as one of any importance, whatever Professor Warren may think about it. Nothing that Mr. Haycroft on the one hand, or Mr. Eddy on the other, have said with regard to the mere question of the weight of rails on the Great Western Railway seven years ago would operate upon our minds. The question we have to consider is whether the rails on the New South Wales Railways will bear the Baldwin engines. Supposing Mr. Eddy, in regard to the particular matter about which Mr. Haycroft has written, is wrong—I am not saying that he is wrong—but even supposing that he is wrong, what bearing has it upon the question at issue, and how can it justify the time of the Commission being taken up with what really concerns the personal vanity of any individual.

7497. *Mr. Fehon.*] Mr. Haycroft's evidence, with regard to the weight of rails, is seven years old, according to his own admission; the evidence that Mr. Eddy gave is the result of information not seven days old.

7498. *Mr. Hoyle.*] In the cross-examination of Mr. Eddy, I will produce the work that Mr. Haycroft wishes to produce, and in that way I think I shall be able to prove that Mr. Haycroft is perfectly right, and that Mr. Eddy is wrong.

THURSDAY, 26 MAY, 1892.

[The Commission met at 2 o'clock in the Board-room, Colonial Secretary's Office.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

ALEXANDER BROWN, Esq., M.L.C., J.P.

7499. *Professor Warren.*] I wish to know if the full report from Messrs. Kidd and Pollock with reference to the trial trip of the Baldwin passenger engine will be put in by the Railway Commissioners, or will these gentlemen be called?

7500. *Mr. Fehon.*] I do not think it will be necessary to call them.

7501. *Professor Warren.*] These tests are most important in connection with what the engines are doing.

7502. *Mr. Brown.*] I think, Mr. Fehon, there can be no question about calling these gentlemen. When Mr. Eddy made his statement before this Commission, he read an interim report from these gentlemen. The Chief Commissioner could not have given that evidence unless he intended to call these gentlemen in person.

7503. *Mr. Fehon.*] One of the two would do, I presume—say, Mr. Pollock.

7504. *Mr. Brown.*] Yes; the interim report is incorporated in Mr. Eddy's statement, and he could not give that as evidence himself for the reason that he knew nothing about it personally. I asked him at the time if he intended to call these gentlemen, and he said "Yes," and upon that understanding the report was admitted.

Mr. W. Thow recalled:—

Mr.
W. Thow.
26 May, 1892.

7505. *Mr. Fehon.*] Are you a member of the Institute of Civil Engineers? Yes.

7506. And also of Mechanical Engineers? Yes.

7507. What has been your experience as a railway man, Mr. Thow? I have had about thirty-two years' experience in locomotive works, with regard to rolling-stock chiefly. I have been on the Lancaster and Carlisle, London, and North-western and Scottish Central Railways, and in their workshops, and have had experience under the leading officers of those companies.

7508. Before asking Mr. Thow any questions appertaining to this Inquiry I should like to put to him one or two questions with reference to the strength of the draw-gear on the goods rolling-stock, reference having been made to it, although this Commission thought that question did not come within the scope of its inquiry—still, for the purpose of acquainting you with the facts of the matter, and through the Press informing the general public as to what has been done, I should like to ask him one or two questions.

7509. *President.*] Yes.

7510. *Mr. Fehon.*] What strain would the old draw-gear used on trucks stand prior to the alteration made by the Commissioners? Twenty-seven or 28 tons would be the breaking strength, I think.

7511. Would it not be better, in order to make it more intelligible, to state it as compared with the hauling power of the engines? Yes, perhaps so.

7512. Well, what would the breaking strain be? For the engines that we employed at the time when we had the old draw-gear in service, we had a strength of three times the hauling power, so did not put a strain on the draw-gear of over one-third of its breaking strength, that is to say the draw-gear then in use was able to stand three times the hauling power of the engine; at no time can draw-gear be more severely strained than the power of the engine hauling it, it cannot at any time be greater than the tractive power of the engine. Perhaps I may illustrate that statement—take for instance the very heavy engines, which have been spoken of as throwing an undue strain upon the draw-gear, Consolidation engine for instance: its tractive power is about 21,000 lb., say 10 tons roughly—now the meaning of that is this—supposing a rope were fastened to the tender-hook or the hook at either end of the engine, and slung over a pulley and allowed to drop into a well, then if a 10-ton weight were attached to the end of the rope the engine could not move. I use this illustration to show what the strain is that passes through the draw-gear. The power of this large 98-ton engine is not sufficient to draw a 10-ton weight out of a well if attached to it; that is the measure of the greatest strain that could be put on the draw-gear. With the smaller engines we had in use before the introduction of these large engines, the strain put on a draw-gear could not be more than 7 or 8 tons, and the factor of safety would therefore be from three to four in the old draw-gear; at the present time we have increased the strength of draw-gear until the strain is from 47 to 53 or 54 tons, so that we have now a factor of safety of from four and a half to five.

7513. *Professor Warren.*] Five-four according to our figures.

7514. *Mr. Fehon.*] The draw-gear is sufficiently strong under ordinary circumstances to stand four and a half to five times the strain that can be brought to bear upon it by a Baldwin engine? Yes; assuming that the engine is carefully handled.

7515. Is the whole of the old rolling-stock now fitted with this new draw-gear? Yes.

7516-7. Would not two engines coupled together be much more likely to break the draw-gear than one engine of greater power? Yes; certainly. We have a rule in the service that if two engines are worked together the load shall never be greater for the two engines than 50 per cent in addition to the load of the one engine, that is to say the power of the two engines being, say 200 tons, the load shall never be more than 150 tons. Even if two engines were attached to the train, to illustrate by the same means the strain they imposed, we should be able to raise 12 tons instead of ten; that is to say, the two engines would have the power to lift 12 tons, in a vertical direction, out of the well.

7518. *Professor Warren.*] That is 2 tons more than before? Yes; practically 20 per cent. more.

7519. Then if the strength of the present draw-gear is nearly five times that of the hauling power of the engine can anything more be done to ensure the safety of trains on inclines? I do not think anything more can be done, I think it is an ample provision.

7520. If a coupling breaks now, what do you attribute this breakage to? To one of two causes—it invariably shows that one of two causes has been at work, namely, that either the engine has been carelessly worked so as to bring an unusual strain upon the draw-gear through what is termed "snatching," or the coupling is defective through bad welding or some such cause.

7521.

7521. *President.*] What do you mean by "snatching"? Sudden jerks, thus bringing an undue strain upon it; and we also find that a large number of those which do break are defective through bad welding, careless workmanship, or other such causes.

7522. *Mr. Brown.*] There is a little due to careless driving, you say? Yes; that is the "snatching" I have referred to.

7523. *Professor Warren.*] But you may have a "snatch" with even a most careful man? Yes; it sometimes happens that the most careful man may be misled, and a snatch may result. Those "snatches,"—by careful men—however, rarely or never cause breakages of a coupling. They are very moderate, as a rule, and do not cause damage.

7524. Were there any engines on the New South Wales railways of equal power to the Baldwin passenger and consolidation prior to their arrival? No; none of them. You must, of course, compare goods engines with goods engines, and passenger engines with passenger engines. Then my answer would be correct. There are no engines so powerful by a considerable amount comparing class with class.

7525. Were there no engines, taking them as a whole, so powerful as the passenger or consolidation engines? Yes; we had goods engines more powerful than the Baldwin passenger engines.

7526. *Mr. Brown.*] As a matter of fact, you use these engines each for its own particular purpose? Yes; the high speed for passenger trains and the low speed for goods trains.

7527. *Mr. Fehon.*] The fourth charge made by Mr. Hoyle at this inquiry is that there are engines already in use on our railway system that are as powerful as the Baldwin passenger engines, and therefore another type of engine has been added to our stock, thus increasing the already too many types of engines already in use.

7528. *Mr. Hoyle.*] This charge has already been disallowed, and if it is now raised I shall have to traverse it.

7529. *President.*] Yes, I think Mr. Eddy objected to it on the ground that it affected the policy of the Railway Commissioners generally.

7530. *Mr. Fehon.*] I think the one disallowed was that the Baldwin passenger engines are not required, and should not have been imported, as orders had already been sent out of the Colony for sufficient engines to meet all requirements of the Railway Department, and that the money thus spent was therefore unnecessary expenditure of public funds.

7531. *President.*] Yes; that was disallowed, certainly.

7532. *Professor Warren.*] I have always been under the impression that we had nothing to do with the ordering of the engines.

7533. *Mr. Fehon.*] The fourth charge was that there were engines already in use in our Railway system that were as powerful as the Baldwin passenger engines, and therefore another type of engine had been added to our stock, thus increasing the already too many types of engines in existence.

7534. *Professor Warren.*] I am not quite sure about that.

7535. *President.*] I think that is part of the railway policy of the Commissioners, and ought not to have been allowed.

7536. *Mr. Hoyle.*] I am absolutely certain the charge was disallowed.

7537. *President.*] I am wrong; I wanted to disallow it. If you look at the fourth charge you will see how it stands.

36. *Mr. Eddy.*] I must again object. This charge (No. 3) opens up the whole question of a railway management.

37. *President.*] It has been decided, and I cannot hear you any more. It has been decided by a majority of the Commission to admit the charge (3.)

38. *Mr. Hoyle.*] (Repeated the fourth charge). It has been said, in inspired paragraphs to the Press, that we had no engines here powerful enough to do anything like what these engines can do. I say that we have engines quite powerful enough for that purpose.

39. *President.*] That is entirely outside the scope of this inquiry;—I understand you to say that the Commissioners have ordered something that is clearly unnecessary;—the question is whether they have received what they ordered or not; whether these engines were necessary or not does not matter;—that can be no charge? What I am doing is with a strong desire to help the Commission.

7538. No. 4 charge, it will be seen from this, was disallowed.

7539. *Mr. Fehon.*] No. 3 charge was disallowed.

7540. *Mr. Hoyle.*] No. 3 charge is allowed.

7541. *Mr. Fehon.*] Then the question of draw-gear, from your ruling, Mr. President, comes within the scope of the inquiry.

7542. *President.*] Not what you have been pointing out, Mr. Fehon.

7543. *Professor Warren.*] What you have been asking does, I think, come within the scope of this inquiry and has been allowed.

7544. *Mr. Fehon.*] I asked the witness about the draw-gear.

7545. *President.*] And you prefaced these questions with an apology that you do not consider that the matter comes within the scope of the inquiry, but for the purpose of clearing the minds of the Commission and the public as to the actual strength of the draw-gear you desire to ask these questions.

7546. *Mr. Hoyle.*] And for that reason I do not object to them.

7547. *President.*] I think the fourth charge was clearly disallowed.

7548. *Mr. Fehon.*] Do I understand that No. 2 was also disallowed?

7549. *President.*] Yes, and subsequently No. 3 was disallowed, except so far as the hooks on the engines supplied by the Baldwin Company.

7550. *Mr. Fehon.*] Then No. 2 was disallowed because it was a part of the policy of a Railway Commission to determine whether the engines were required or not.

7551. *President.*] This is how the matter stands:—

Charge No. 1 is allowed.

No. 2 is disallowed.

No. 3 is allowed in the sense I have mentioned (confined to the draw-gear of the engines).

No. 4 is disallowed.

No. 5 is allowed.

No. 6 is allowed.

So that there are four charges which this Commission has to inquire into.

7552.

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7552. *Mr. Fehon.*] More accurately, three and a half, sir.
7553. *Mr. Hoyle.*] Charge No. 3 is only disallowed when I commenced to speak about the draw-gear attached to the goods stock. The Commission allowed it, except as regarded the draw-gear attached to the trucks. It was allowed with regard to the draw-gear attached to the engine itself. However, if Mr. Fehon thinks that the evidence he wishes to give would allay public alarm I have no objection to its being given.
7554. How many additional vehicles would these engines draw as compared with the most powerful engines in existence on our lines previously. Say, roughly, how much per cent. more would they draw?
7555. *Witness.*] I should say 60 per cent. more.
7556. *Mr. Hoyle.*] That applies to both the goods and passenger engines? Yes; I gave an answer intending to show what the power of the previous engine was—namely 60 per cent. of the Baldwins.
7557. What percentage more do you think the passenger engine would do, compared with the most powerful passenger engine we had previously? Generally speaking, I should say 40 per cent. more load would be taken by the present passenger engines than by those prior to the arrival of the Baldwins.
7558. If it refers to all the sections on the line then the most powerful was also a Baldwin engine. It was the Baldwin Consolidation engine which was confined to the western section only.
7559. Was that used for passenger or goods? Goods.
7560. What was the most powerful passenger engine? The 304 class. There was another class, which was imported about the same time, known as the Vulcan. This was, theoretically, more powerful; but, as a matter of fact, it does not take the same load as the 304 class, because it has not sufficient weight on its driving-wheels to give it the necessary tractive power, although its cylinder power is greater.
7561. Were these more powerful engines used on the express train? No.
7562. Why? They did not seem to stand the speed of the express train. The 304 class would not do that work. I mean the Baldwin 304 class. There are two types of that number—one made in America, and one in Scotland. The American is the one I speak of—the original 304 class.
7563. Was not a mistake made by the Baldwin people in supplying a smaller size hook on the engine than was shown in the drawing sent by the Railway Commissioners? Yes, by $\frac{3}{8}$ to $\frac{1}{2}$ an inch in depth.
7564. Have they not acknowledged their mistake, and remedied it in accordance with the original design? Yes; they have put in new hooks at their own expense.
7565. Do you know when Mr. Hoyle made his speech in Parliament on the Baldwin engines? On 20th August, I think, last year.
7566. Yes, how many of the engines were then in steam? About seven of the passenger engines had been partly tried; but they had not been run very much.
7567. Were they doing regular work? No; not put to the express work—they were running their mileage at that time; they were employed on express goods and ballast trains only.
7568. They were not doing the regular express work at all at that time? No.
7569. Had any of the goods engines arrived then? No; they had not arrived in the Colony.
7570. Had any mishap occurred to any of the engines at that time? No; not of importance.
7571. What was the date of the first accident to the Baldwin passenger engine? The first axle broke on the 27th October.
7572. Then at the time Mr. Hoyle was making his speech, the engines were doing very good work, and you had no fault to find with them? Yes; I considered that they were doing good work then.
7573. When the defects of the bogie axles developed, were not the engines immediately taken from express traffic? Yes; as soon as we knew of it they were taken off the express trains, and as soon as we could do so, they were taken off all the passenger trains—but immediately off the express.
7574. Were not steel axles introduced instead of iron? Yes; as quickly as possible.
7575. Were not the Baldwin Company communicated with, with reference to the defects in the bogie axles? Yes; and we expedited the change by getting six axles from the Railway Department of Victoria—we made inquiries in all the colonies to obtain axles from them, but we only succeeded in getting the six from Victoria.
7576. And in the meantime you communicated with the Baldwin Company? Yes; immediately.
7577. And they sent out steel axles to take their places? Yes; they sent out twenty-four for the Baldwin passenger engines.
7578. Since these steel axles have been fitted, have you had any cause to complain, with regard to the running of these engines? No.
7579. Have not these engines run up to the present time, about half a million of miles? Yes; almost half a million of miles; very nearly so.
7580. *Mr. Fehon.*] You say these engines have run half a million of miles since they have been here, have they not done their work in a very satisfactory manner? Yes; I think so, with exception of defects already mentioned.
7581. Have not the introduction of these engines enabled you to exercise very considerable economy in the running branch of your department? Yes; the large engines are doing that very materially.
7582. From your knowledge of the gradients of the New South Wales railways, do you not consider it a very judicious step to import engines of much greater power than those previously used on the line? I think so.
7583. Were the engines inspected as they were being put together? Yes.
7584. Carefully inspected? Yes; I think so.
7585. It has been remarked by some of the witnesses at this inquiry that it was a mistake to put 6-inch steel instead of 5-inch iron into the bogie axles;—what has been the experience since the alteration was made? They are running very well, and they are not giving any trouble.
7586. Has it not been necessary with other classes of engines to insert a larger sized axle? Yes; it has been found necessary occasionally to put in a 6-inch instead of a 5-inch axle, for example in 304 class.
7587. What about the Scotch Yankees and the first Baldwin? Some of the Scotch Yankees, I think, had their bogie axles changed. Wherever we have changed the axles we have put in a 6-inch steel axle.
7588. A number of petty matters have been introduced, statements having been made that certain parts are showing excessive wear;—speaking generally, are any parts showing signs of excessive wear? No; not with Baldwin engines; not when the work done by the engines is considered. When you have heavy work done you must expect to have considerable wear and tear. That follows as a matter of course.

7589. There are one or two questions I would like to ask you with reference to the speech made by Mr. Hoyle, as he stated in Parliament his political existence depended upon them; he said he would be snuffed out of political existence if he did not prove these charges up to the hilt, he stated, "There is an excessive weight on the driving-wheel, and whenever the full power of the cylinders is used, instead of the engine pulling the load the wheels skid round and do not draw the load at all;"—is that true? No; I do not think that is correct. It seems to me to be a contradiction in terms.

7590. Mr. Hoyle also stated, "That proved that twelve engines have been brought to this country to perform work for which they were unfitted, and the money expended on them has been wasted";—what do you think of that? I do not think that it is correct. If the engines are likely to do their work well I do not think that the money expended upon them can be said to be wasted.

7591. Do you think any man knowing anything about a locomotive would make such a statement? I do not know what was in Mr. Hoyle's mind at that time, but I think that was rather a sweeping statement to make.

7592. *Mr. Hoyle.*] That refers to the compound engine.

7593. *Mr. Fehon.*] In the same speech Mr. Hoyle also stated that "According to the latest information from the cleverest men in the United States the Boards of Railway Management there, these engines cannot run with safety on a rail less heavy than 80 lb.";—do you not know that engines with heavier weights on their driving-wheel are running on lighter rails than ours? I should not think the weights too heavy for our rails. So far as the rails are concerned, the 75-lb. iron rail which we have upon portions of our road, if of good quality, it ought to carry that weight very well, in my opinion. I do know that on English railways very heavy weights on the driving-wheel are run upon some of the lines. Taking the Great Northern Railway as an illustration, I think the weight of their rail some years ago was 82 lb. or 84 lb. to the yard, and that company was then running engines which had 18 to 19 tons on the driving-axle, and they were running express trains from London to York with those engines. The weight of a rail is generally made heavy to provide for wear, tear, and endurance.

7594. *President.*] In short, for purposes of economy? Just so.

7195. You give additional weight to a rail for purposes of economy, and not for additional strength? Undoubtedly, the increase of weight during recent years has been for that reason; simply for purposes of economy.

7596. *Mr. Fehon.*] Mr. Hoyle, in another place, says, "I am willing to stake my existence on the fact that we have engines in the service that can do anything to be done by these engines from America."

7597. *President.*] I do not think you need trouble about that, Mr. Fehon. I do not think anything Mr. Hoyle may have said in Parliament will affect this Commission in any way.

7598. *Mr. Fehon.*] Mr. Hoyle further said, on the 18th November last, that, "They had to put new steel axles into the job (that is the engines), but the engines will be useless, for they are wrong in principle and bad in construction"; he said also at that time, "I will prove that, and stake my political existence on it"; as a matter of fact, are these engines wrong in principle or bad in construction? I think they are very well proportioned. They have large cylinder power, great area, and suitable load on the axle. All these are in excellent proportion, and I do not think you can improve them; and as to the defect of slipping, seen in the class of engine known as the Vulcan, slipping the wheels on account of the too high cylinder power for the weight on the axle, we do not find anything of that kind in these new engines. They do not slip to any greater extent than I would expect them to do. All engines ought to slip their wheels under certain circumstances; otherwise, it shows there is not a proper balance, but they will only do this when the rail is greasy, and not when it is dry.

7599. Were not the 30½ class engines, which Mr. Midelton claims as his design, running in America years before any were imported into this country, with the alteration only of doing away with the dome and a few minor things which did not affect the construction of the engines in the slightest? So far as I know they seem to be of the ordinary construction of American engine. I do not know in what way they are unusual in design. That is a type of engine which has been used in America and also here for many years prior to the introduction of what has been called "the Midelton engine."

7600. *Professor Warren.*] Do you mean the 75 tons in steam.

7601. *Witness.*] That is the 30½ class. [*Photograph produced and shown witness.*] No; that is not the engine. If you have any papers in which there is a report by Mr. Allison Smith and Mr. Roberts you will find an illustration of the engine there.

7602. *Mr. Fehon.*] How many old Baldwin engines were used on the line prior to the new ones being introduced? Thirty-three.

7603. There was no experiment in ordering Baldwin engines? I think we knew what they were.

7604. Are not nearly all the tramway motors running here purchased from the Baldwin Company? Yes; almost all of them.

7605. Did they not do their work sufficiently well to justify the Commissioners in going to the same manufacturers when they were in urgent need of engine-power? Yes; I think the circumstances under which these engines were ordered justified the Commissioners in going to those people, as they were the only ones who could deliver them to us in time.

7606. *President.*] I understand that some English syndicate had disappointed you with regard to certain engines that you had ordered; you could not get them in time from England; in time to provide for the then coming wool season, so you had to go to the Baldwin Company,

7607. *Mr. Fehon.*] First of all fifty engines were ordered to be manufactured in the colony—twenty-five were to be made by one firm, and twenty-five by another. Both these firms failed to make the engines, then the Commissioners thought that as an inducement to manufacturers in the Colony or any part of the world to come here and settle down, they would offer 100 locomotives to be made, but they found that this inducement was not effectual; then the Commissioners were in such a close corner for locomotive stock that they had to go where they could get the engines quickest.

7608. (To Witness.) How long is it since we ordered the first Baldwin engines? I think the first ones must have been in the Colony since 1882 or 1883.

7609. That is about ten years? Yes; about ten years I should say, perhaps longer than that.

7610-11. *Professor Warren.*] It is about ten years since the first Baldwin engine arrived here, you say? Yes. It is about that time, I know.

7612. *Mr. Fehon.*] You have had a good deal to do with testing rails? Yes; at one time I had.

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7613. This is the broken rail from Tarana; do you recognise it? Yes; I see the marks that were put upon it.
7614. Did you submit that rail to any test? Yes; we put portions of it to a test.
7615. Who were associated with you in making that test? There were Mr. Deane, Mr. Foxlee, Mr. Neale, and myself.
7616. What was the result of these tests? The rail broke with a strain of 23 tons by the hydraulic press, and portions of it broke under a drop test with very low drops—one, I think, of 6 inches only.
7617. *Professor Warren.*] Could you put in a copy of these tests? Yes; if I have them I will do so. This paper contains a report, but I see it is not the report I refer to, but one subsequently made. I forget exactly the drop test we used, but it was extremely low.
7618. Did these tests indicate the iron was bad?
- 7619–20. *Mr. Fehon.*] I did not know you were going to ask that question. I shall give the Commission a copy of the test report. The iron had to stand a test dropping a foot.
7621. *Witness.*] I think that is the test which broke it, but I have not a copy of the report with me, so I cannot say what it was exactly.
7622. *Mr. Fehon.*] I can get another witness to speak to that.
7623. *President.*] If it were only a ton dropping 1 foot, that showed it to be very rotten iron, did it not? Yes; it indicated that the iron was very bad indeed.
7624. *Mr. Fehon.*] Do you not think that any man looking at that rail and understanding iron would know it to be bad? Yes; the crystallisation shows it.
7625. *President.*] What does crystallisation show? It shows that the iron was very brittle.
7626. Would it show that it was bad originally? Not necessarily; but at the time the fracture occurred the iron had either deteriorated or had been bad originally.
7627. *Professor Warren.*] Would it not show that it was broken by a sudden blow rather than being drawn out suddenly? My experience is that good iron even when broken suddenly will show a different appearance from what this rail does.
7628. It will show a crystallised fracture? Yes; but not a fracture of that nature.
7629. *Mr. Fehon.*] It has been said in evidence, by experts, that that rail would stand a drop test of 22-foot tons; they professed to be acquainted with what it ought to stand.
7630. *President.*] How much did you say?
7631. *Mr. Fehon.*] From 15 to 22-foot tons, that was the statement made by different engineers and iron experts who have been called to give evidence.
7632. *Witness.*] It was broken with a very small fall.
7633. If it were good iron could it stand a test of more than 22-foot tons? I should think 8 or 12-foot tons would be sufficient for it.
7634. *Professor Warren.*] If it were a good iron rail? Yes.
7635. *Mr. Hoyle.*] I think you said with regard to the breaking of couplings that most of them had been broken through careless working and careless welding? I said that most of those which had broken showed signs of bad workmanship.
7636. Can we have any guarantee against such careless workmanship? It is one of the risks of railway working.
7637. Relative to the draw-gear on the trucks, what is the greatest load that can be hauled by the old Consolidation, Mr. Thow? That depended entirely on the section of the line you haul the load over.
7638. Taking the load from Penrith to Katoomba or Bathurst? In goods traffic sixteen waggons from Emu Plains to Katoomba, fourteen coal waggons and twenty empty stock trucks. These are the loads marked down for those engines.
7639. Could the engine haul more than that load? These are the legitimate loads, and they have often to be reduced if the weather is not good.
7640. If it is wet and greasy? Yes; these are the legitimate loads under good circumstances for the engines to draw.
7641. What would be the maximum load for the new Consolidation engine—sixteen goods trucks, fourteen coal waggons, twenty empty stock trucks? I have not got the new load table which would give you the full loads; it will be put in evidence.
7642. There was a doubt in my mind about the hauling powers of the engine—my contention has been that it was a danger to the draw-gear on the goods stock, however that charge has been knocked out? Before we had these large engines we employed two engines to draw these loads, and with two engines coupled together as I have already shown we found that the strain was greater from two than one—with the large Consolidation engine we never couple them together.
7643. But you have a push-up engine behind? Yes, in some places; but that is for a different purpose altogether.
7644. We have already had evidence from the officers at Penrith, who swear that they have frequently used push-up engines, and that this was done for the safety of the draw-gear, rather than with the object of pushing the trains up the bank? I do not think they could take that view of it; but even supposing that were so, when the engine pushes up behind the strain on the draw-gear is greatly relieved.
7645. I find that Mr. Neale, in making his report to the Railway Commissioners, gives the load as eighteen waggons for each old load, so that the old load would be eighteen waggons, and the new load twenty-five waggons.
7646. *Witness.*] Does he give the engine?
- 7647–48. What he says is this: "Our best available engines haul a load of only eighteen trucks up 1-40, which is practically the ruling grade on the most important parts of our main lines, the proposed engine would, I estimate, haul easily twenty-five loaded waggons. This would not only mean an increase of nearly 40 per cent. in the load, for $37\frac{1}{2}$ per cent. increase in the first cost of the engine, but would give a greater increase in the earnings without any appreciable increase in the cost of working, as shown by the following figures of the estimated annual earnings and expenses of a main line engine on the basis of 25,000 trains per annum." *Witness.*] But I am speaking of a grade of 1 in 30 and 1 in 33.
7649. *Mr. Hoyle.*] I presume that he was stating the ruling grade throughout. He says that 1 in 40 is practically the ruling grade on the most important parts of our main lines.

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7650. *Mr. Fehon.*] The ruling grade is the steepest grade.

7651. *Witness.*] When coming over the big Zig-zag, where you have a grade of 1 in 42, there is a load of twenty-one waggons arranged for these particular engines when coming towards Sydney, twenty-one goods, nineteen coal, sixteen cattle, and seventeen sheep trucks—so you see the difference it makes in going from a grade of 1 in 30 to 1 in 42.

7652. You must drop some of your load, or take a push-up engine;—have you not a number of engines at Penrith now specially designed for push-up work—Saddle tank engines? These engines were got for two purposes, either for pushing up or for taking the heavy mineral traffic at Newcastle.

7653. But the object of sending them to Penrith is for pushing up? Yes; you must understand that these engines you speak of have the same power as the old 205 class; they are not new engines.

7654. They are at Penrith now, however, on account of their power for pushing-up purposes? They are handy engines, but they were not got specially for that purpose.

7655. It has been sworn to that these push-up engines were put on more for the purpose of protecting the coupling than of helping the Baldwin engines;—do you say that you do not take that view? I do not take that view.

7656. Inspector Duff said that these engines were used more for protection than for assisting the Baldwin engines. Mr. Fehon has asked you about certain things relative to the Baldwin engines;—I think you were out of the country when these engines were ordered? I was.

7657. You were never consulted about the importation of these engines? The necessity does not appear to have arisen for these engines before I left the country.

7658. So that you knew nothing about the necessity for them? No.

7659. Nor about the specifications? No.

7660. Only when you were in England you received the cablegram asking you to do certain things? I heard, somehow, when in England that the engines had been ordered.

7661. Did they reach here before or after your arrival? After my return.

7662. When these engines were put together did you personally make a close inspection of them? Yes, I saw a good deal of them—close inspection may mean a different thing to you to what it does to me, my works manager, Mr. Howe, made a close inspection of them, and if he saw anything he thought required my attention he called my attention to it, I also inspected them myself in going through the works, and I made a point of looking at them when the men were away, I frequently saw the engines in walking through the workshops.

7663. Did Mr. Howe report to you anything that he thought defective about these engines? He drew my attention to the wheels among other things, pointing out that there were various holes in them filled up with putty, he also drew attention to what he thought were flaws in the spokes of the wheels, we had wheels and spokes examined, and the putty taken out—and I came to the conclusion that they were a very rough job—a rough piece of forge work, we did not arrive at the conclusion that there was any want of strength about them.

7664. Were there any defects in other parts pointed out to you? I do not remember any particular parts at the present time. Not until the engines commenced to run.

7665. Then you had bad axles? Yes, and there were various parts which had to be attended to, for example, the draw-gear and the reversing-gear, and the wear and tear on the axle-boxes, these were pointed out to me after the engines had commenced to run.

7666. The wear and tear on the axle-boxes you refer to—do you consider then it was excessive, considering the time that these engines had been running, I am speaking of the boss of the axle-wheel working into the axle-boxes? Yes, I do, as compared with English engines; but you have to compare these engines, not with English engines, but with similar ones from America such as we had before, and there you will find that the wear and tear on the American engines, or I should rather say the Baldwin engines, (because I have not had experience with other American engines) has been greater than with English engines.

7667. Did you get greater work out of the American engines than out of the English? Yes, we got greater work out of them on account of their having greater power, when compared with small English engines.

7668. With regard to the previous Baldwins, did you get enough additional work out of them to compensate for the greater wearing away that you have spoken of? Yes, the old Baldwin was a more powerful engine than any English engine that we have had until the new Manchester engines arrived.

7669. Did you have more wear and tear in comparison with the old Baldwins when the new engines commenced to run? I think there was quite as much wear and tear on the old Baldwins as the new ones of the Consolidation type; but not if you compare them with the passenger type. When you are running trains at a high rate of speed you must expect greater wear and tear, that follows as a consequence.

7670. You were speaking just now about the weight of rails upon which some of these heavy engines run in America and England, you say that with a 67-lb. rail they run at a high speed? I spoke of very heavy weights upon the driving-wheels running in England on heavy rails. I did not refer to America. I am not acquainted with the American lines.

7671. Then these heavy weights are running in England on 80-lb. rails? Yes; 82 and 84-lb. rails.

7672. Do you know anything about the spacing in England and America? Yes. In England the universal custom at the time I am speaking of was to have rails 21 or 24 feet long, and in almost all cases the spacing was as follows,—21 ft., eight sleepers; 24 ft., nine sleepers, so that you would have about 2 ft. 9 in. centres. In America the sleepers are spaced much closer.

7673. The custom in England then would be to have the sleepers spaced about 2 ft. 9 in.? Yes, about that. And I should like to say that the sleepers in England are soft wood as compared with the hard wood we have here, which as you know makes a considerable difference.

7674. But in some cases they have cross ties on the English rails? There are no ties.

7675. But take the Great Western for example? Oh, that has longitudinal sleepers, that is quite a different thing.

7676. About the Scotch-Yankees—You know that their axles were taken out, and a comparative statement has been drawn up by your Department with regard to this matter. When you took these axles out of the Scotch Yankee engine, did you do so because they were defective? The reason was because they were running hot. They could not be kept cool. The engines were being constantly
lifted.

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lifted, and I came to the conclusion that we should get better results by putting in larger axles, and this has been borne out by experience, for now they are giving no trouble.

7677. As to the Scotch Yankee, I take it that that was pretty well all that was the matter with them, namely, that they were running hot? We spent a great deal of money on them, and we had them a long time in the Colony before we ran them on passenger trains at all. They had no hand-brake on them.

7678. If they had no hand-brake that would come to the same thing as altering the light hooks of the Baldwin engines? I thought it was with reference to the cost the Department has been put to with regard to the engines that you referred. The Department paid for the hand-brakes.

7679. I notice with regard to the ten Dubs engines that there is a great difference in the class of repairs carried out upon them as compared with the Consolidation engine? Yes; there are a great number of the detailed parts of the Consolidation and passenger engines which have gone wrong, whereas the main troubles with the other engine were the altering of the axles and putting on the hand-brakes, which runs up the cost very considerably.

7680. I see that you charge the renewal of the axles and hand-brakes against the engine in the one case but you do not charge the renewal of the axles against the cost of the Baldwin engines? Well, it is not our work, the Baldwin Company have sustained the cost of it, and therefore we have not charged ourselves with the expense of putting these new axles in the Baldwin engines.

7681. But it was done in the Scotch-Yankee case on account of the defects in the axles, but the Baldwin engines with just the same defect, it is not shown against their cost? It was admitted by the Company that it was a mistake, the Department did not pay in the Baldwin case.

7682. There are a great number of details in the running-sheds against the Consolidation and passenger engines, whereas with regard to the other engines the repairs made have been chiefly hand-brake, and axle repairs, so that I do not think this comparative statement is a very fair one? I think the object of the Department was to show the comparative cost of these engines to the country, and the charges which made up that cost.

7683. This statement is from the 11th February, to the 29th March, 1892, and the twelve passenger engines have a total sum against them of something like £400 or £500, and the other engines have been running a very much longer time?

7684. Will you read the dates given?

7685. There are no dates. This shows simply a return of one month—it shows that all these repairs have been made in one month, from the 11th February to the 29th March. We have wages, £306 14s. 1d; stores, £77 1s. 7d; charges, £71 11. 6d., making a total of £455 7s. 2d. For the twelve passenger engines the cost of repairs and alterations are given as follows:—

	Total.	Average per engine.
Alterations	£113 9 10	£9 9 2
Shop repairs (excluding cost of repairs through accident)		
£79 9s. 10d.	£375 17 4	£31 6 5
Running repairs	£481 2 7	£40 1 11

With regard to the other engines there are no dates given? May I look at that statement.

7686. *Mr. Fehon.*] This question has no reference to the subject under inquiry.

7687. *Mr. Hoyle.*] This return has been put in evidence.

7688. *Mr. Fehon.*] These questions are going into a great deal of irrelevant matter, not bearing on this inquiry.

7689. *Professor Warren.*] I think the questions do bear on the case very decidedly, the amount of money spent in repairs on the engines is very important. If Mr. Hoyle had not asked these questions I should have done so on this very return. (Witness) I can give you all the dates you require, and I assure you that the time taken in making the comparison was as similar as we could get. The statement with regard to the Baldwin engines is I think brought up to date.

7690. I think it would be fairer if we had a return showing the cost of these engines from the time they commenced to run up to the initiation of this Commission? The date of the issue of the shop order was the 30th August 1891, that is about the earliest, then the return is brought up to the 25th February, that is the latest, you will see that the dates are given there. My impression is that in dealing with the repairs for the Scotch Yankee we took a similar period after their arrival in the Colony. The expenditure is not brought up to the date, but up to a similar time after their arrival in the Colony to that during which the Baldwins have been here. I could give you the dates, I think.

7691. I think it has been given in evidence that these engines were lifted several times in the North, but I do not see anything in the return about that.

7692. *Mr. Fehon.*] Taking the charge that the Baldwin engines are faulty in design, the question of their design is a right matter to inquire into, but the question whether the engine had to be lifted or not is altogether different. All engines have to be lifted, and to compare them with other engines which have to undergo repairs would serve no purpose. All that appertains to this inquiry is to ascertain whether these engines were faulty in design, and if money had to be expended by the Railway Commissioners to put them right, which ought not to have been expended. That is a legitimate question, but to go into matters of shop repairs will carry on this Commission interminably.

7693. *Mr. Hoyle.*] The question of the axles of the Baldwin engines running hot has formed a great portion of the examination of witnesses. It is not easy to find out whether this is due to the design of the engines or not. Some of the witnesses would not say, some said it due to laminations of the iron used, but at all events it is a charge that has been made against the engines.

7694. *Mr. Fehon.*] We admit everything in regard to the axles, there is no necessity to ask any questions about them at this stage of the inquiry.

7695. *Professor Warren.*] I do not think Mr. Hoyle has asked any questions so far that he should not have asked. His questions show that expense has been incurred in making repairs which should not have been incurred if the engines had been originally sound. If the cost is abnormal it shows that there is something more defective in these engines than is met by ordinary repair. If there is an unduly large number of breakages it might show that there was something faulty in design. It is hard to say whether these things are of faulty design or not. This return furnishes certain information with regard to the goods engines, and Mr. Hoyle is now asking questions as to the statements which compare one engine

engine with another. The Commissioners have made this comparison in a return they have put in, and I see nothing wrong in Mr. Hoyle's question.

7696. *President.*] You may go on if you like, Mr. Hoyle.

7697. *Mr. Hoyle.*] I think I have examined sufficiently upon that point. Relative to the test of these rails, Mr. Thow, you say that they broke with a drop of about 6 inches, with a monkey weighing a ton? I said afterwards that I had not the figures with me.

7698. But it was about that, it was a very small drop? Yes, 6 inches to the foot or something of that kind.

7699. Have we any guarantee that there are not many other rails on the road of a similar kind? Well, I cannot say that, it does not come under my supervision in any way.

7700. *President.*] Can you tell us whether a rail can be ascertained to be defective by merely looking at it when it is on the road? I do not think there is any external sign which would show it to be bad on mere inspection.

7701-2. Could you tell it by sounding? No.

7703. Then it is one of the risks incidental to permanent way? Yes, that is so.

7704. *Mr. Hoyle.*] Did one of the tender axles break on the mountains last Saturday week, I mean of the tender attached to one of the Baldwin engines? Yes, an axle did break.

7705. There was a report of this tender axle breaking? Yes.

7706. Has that axle been tested? Yes, partially by the drop test.

7707. And have the Department determined to take out all the axles? Yes, we determined upon that some time ago, and the work has been going on.

7708. *Professor Warren.*] Is that to be done on the Consolidation engines? We have taken out a number of the axles in the Consolidation engines too.

7709. Was this a Consolidation engine? I think so. Yes; upon referring to my book I see it is.

7710. *Mr. Hoyle.*] What was the test it stood? We tested two pieces; the axle was broken on the road in the middle, at almost equal distances from the wheels. We tested both pieces under the drop test. The first piece received blows of 3, 4, 5, 6, 7, 8, 10 ft., and it broke at the seventh blow with a drop of 10 ft.—that is to say, 1 ton falling 10 ft.; the second half was tested with blows of 7, 8, and 9 ft., and it broke after the third blow, with a drop of 9 ft.

7711. Do you consider that a satisfactory test? No; I do not think that the iron was good. I think that had it been good iron it should have stood a much more severe test.

7712. Are there any more axles of that description in any of the tenders of the passenger engines? I am not quite sure; there may be a few, but most of them have been changed.

7713. In the tender wheels? Yes, in the tender wheels.

7714. They have not all been removed from the Consolidation engines, have they? No.

7715. It is one of the Consolidation engines, I believe, that runs the mail train;—do you think it wise, under these circumstances to allow one of these engines to run a passenger train? I do not think there is much risk; its speed is very slow—it does not exceed much more than 18 miles an hour, at least, that is the speed between Peurith and Katoomba; it has heavy climbing all the way, and therefore the speed is slow.

7716. This particular engine whose tender axle was broken was attached to a goods train? Yes.

7717. Since that there has also been a broken tire, has there not? Yes; a tender tire.

7718. Have you made any tests of the quality of that steel? No.

7719. Do you intend to do so? It might be well to do so, but tires often break—tires received from all makers—they sometimes break in the same way. The fact of this tire breaking did not attract much of my attention, because it is not very uncommon for a tire to break in that way.

7720. But it is a very dangerous thing though? It would be very dangerous if it came off. We have tires which break, but they do not necessarily come off.

7721. I have here a copy of the *Engineering News*, dated 21st March, 1891. It relates how a broken tire accident was averted, and it gives a section of the broken tire which was held by Mansell retaining rings. It says, "When the engine reached the engine-house after making this run (130 miles, without a stop, at the rate of about 40 miles an hour) the tire was found broken nearly square across, as shown [in the diagram]. As will be seen from the accompanying section the tire was still tolerably thick, $\frac{3}{4}$ in., and only moderately worn in the tread, and the fracture was wholly without visible cause or excuse. Such fractures usually are. At what point in the run it occurred cannot now be known, but it is almost certain that except for the retaining ring the tire would have left the wheel, and it is quite possible that the result would have been as serious as at the St. George disaster, on the Grand Trunk Railway, about two years before, when a score or so of lives were lost as an effect of a similar breakage, since which date the Grand Trunk Railway has been using Mansell rings on the wheels of its passenger engines."

7722. *President.*] Would you not regard that as an advertisement for the Mansell ring manufacturers?

7723. *Mr. Hoyle.*] Would it not be a very dangerous thing for a tire to break? It might be if it came off, as I said before.

7724. Do you remember the Sunday we were engaged in making the trial trips? Yes.

7725. Was a rail broken on the line that day? Yes; but not by the engine we had.

7726. How do you know?

7727. *Mr. Fehon.*] Because we did not go over it until after it was found broken.

7728. Then it was discovered before the engine I refer to reached it?

7729. It was an 80-lb. steel rail, and it was broken by a man hammering it.

7730. *Witness.*] The Baldwin engine and the engine you had in front of your train passed over this rail after it was discovered, without the slightest risk or danger.

7731. *President.*] Did we go over it? Yes; but of course we knew all about it, and it was perfectly clear there was no danger; it was just like the ordinary joint, but without fish-plates.

7732. On Easter Saturday, was there not a break-down on the mountains in connection with a tourist's train with a Baldwin engine attached to it? There may have been, but I do not recollect it.

7733. Well, I think if you will make some inquiries you will find that it was so, because as a matter of fact a friend of mine happened to be in the train and told me of the circumstance. You do not know what part of the engine broke down do you? No; I do not.

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7734. As I say, a friend of mine was in the train and told me of the break-down, saying that there was a considerable delay in consequence? We have had trouble with the reversing-gear, as you know, and the break-down you speak of may have been in connection with it.
7735. Have you had much trouble with the reversing-gear since you have had the engines? Yes; we have changed a good many of the screws and are going to change more.
7736. Were those defects the result of bad workmanship—did they arise through anything that occurred in the shops? No; they were the results of inefficient designs.
7737. And you have had to renew the reversing-gear on a great many of them in consequence of it? We are renewing the reversing-gear at the expense of the Baldwin Company.
7738. That does not matter to me for the purpose of this inquiry whether the Baldwin Company pay for the renewals or not, the charge sets out that the Baldwin engines were defective in design and construction? You must understand that ordinary reversing-gear cannot be used on the steep grades of our lines; they are much steeper than anything they have in America, and the Baldwin Company did not know what our requirements were, all they knew was that we had asked for reversing screw gear, but as they always use levers instead of screws in America, they had not made anything of the kind before. They did their best, but their best has not been strong enough. Our heavy grades put such a strain upon the motion of the engine that the reversing gear has to be unusually strong, otherwise it will not last.
7739. *President.*] Then would the reversing-gear that the engines came out with have been sufficiently strong for the requirements of an engine running in America? Oh; it would have been strong enough.
7740. *Mr. Fehon.*] You might ask Mr. President whether in point of fact is it not the universally used reversing-gear.
7741. *President (to Witness).*] Yes. Was the gear that the engines had when they came out the kind of gear that is always used in America? No; the usual gear used in America is a lever, but these engines came out with screws. We have to abandon the lever in this country and use a screw, because of our very heavy grades.
7742. *Professor Warren.*] Have they not very heavy gradients in America? Is not for instance that Baltimore and Ohio used on a 137-mile grade? Well; they have some steep grades in America, of course, but generally speaking their ruling grades are nothing like as heavy as ours.
7743. *Mr. Brown.*] Did you go over the Marshall Pass, on the Rocky Mountains, when you were in America, Mr. Thow? I know the part you are alluding to, but I did not go over it, although I went by Rio Grande Route, and of course there are some exceedingly heavy gradients there.
7744. *Mr. Hoyle.*] Did you see a report in yesterday's *Daily Telegraph*, stating that the coupling of the Melbourne express broke? Yes.
7745. Had that anything to do with the reversing-gear? No; I might explain how it occurred. The coupling that broke was an old screw-coupling put on by mistake at Redfern station, between two carriages.
7746. Can you tell us—but perhaps you cannot—as you were not here at the time the engines were ordered, whether the Baldwin passenger engines were brought here to run the express service? I fancy they were.
7747. If you will allow me for a moment I will read a paragraph from the *Sydney Morning Herald*, of 26th June, 1891. In that paper it is stated that, the locomotives are of the ten-wheel make-six driving-wheels and a four-wheeled truck, and attached to each is an eight-wheel tender. They are the heaviest and most powerful locomotives introduced to the Australian continent. They are guaranteed to accomplish double the work of any engine now in use on the New South Wales railways. For instance, one of the new engines will run an express train to the Northern and Southern borders as quickly and as safely as two of the ordinary locomotives do similar work now." You have heard that extract, Mr. Thow, can you tell me whether the facts are as stated?
7748. (*President. (To Mr. Hoyle).*] One moment, I do not understand the nature of your question exactly. What paper is that you are quoting from? Mr. Hoyle: The *Sydney Morning Herald*, of June 26, 1891.
7749. *President.*] Yes, it does not matter what paper it is. The only question is whether it is admissible as evidence, and in order to determine that we must know whether the information was supplied by any of the Railway Commissioners, or indeed by any body in the department. Or whether the paragraph is simply a description written by some gentleman whose business it is to write for the papers.
7750. *Mr. Hoyle.*] I do not know who supplied the information, it must have been somebody who knew something about the engines. I conclude that whoever wrote the paragraph must have obtained the information from somebody in the Department.
7751. *President.*] Yes, but a gentleman who wanted to get a paragraph for a newspaper very often comes to the persons from whom he expects to get the necessary information, and after being told a few bare facts, goes back to the office and writes a long description. He arranges the matter as picturesquely as he can, and it would, of course, be unfair to bind the Commissioners to anything that was written in that way. If the gentleman who wrote the paragraph indulged in a little word-painting, it would be impossible to hold the Commissioners responsible for that.
7752. *Mr. Hoyle.*] Well, my only object in reading the paragraph and asking Mr. Thow about it—if indeed he knew anything about it, which, as I said, he perhaps does not—was to save the time of the Commission, because I may think it necessary to bring a number of reporters from the *Sydney Morning Herald* as witnesses to prove who gave them the information.
7753. *President.*] But surely there is no necessity to do that, Mr. Hoyle. You can get all the information you want in regard to the paragraph, if it is in Mr. Thow's power to give you any information, by asking him to answer a few questions upon it.
7754. *Mr. Hoyle.*] Very well, Mr. President, I will not press the matter.
- 7755-6. [*To Witness.*] Can you tell me, Mr. Thow, whether as stated in this paragraph the Baldwin passenger engines were intended for the express service? I believe they were intended to run the express service. It was, however, stated in my former evidence that we intended to run passenger engines in one direction and goods in another; the idea was that by getting these large engines we should be able to diminish the accidents and delays of haulage, and, as a matter of fact, we have succeeded in that to a considerable extent. If the engines were wanted to take a passenger train from here to Bathurst, the same engines should be powerful enough to bring back a goods train, and the new Baldwin engines are sufficiently powerful.

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7757. Were they put on the express service? They were.

7758. And they were taken off I believe because of the breaking of the axles? Yes.

7759. Why were they not put on again? I believe the principal reason was that we had at the time a number of engines from Manchester—the Beyer and Peacock's new engines, which are running the express trains now, and consequently it is not necessary to use, as was previously used, the Baldwin engines for that purpose.

7760. Tell me, then, were these powerful Beyer and Peacock engines which the Commission saw in the Eveleigh workshops here at the time the Baldwins commenced to run the express? No, they were not in the Colony when the Baldwin engines were taken off the express service owing to the breaking of the axles.

7761. Then, what engines were used for the express trains at that time, how did you manage to get along without the Baldwin engines for your express trains when they were taken off after once beginning to run them? We returned to the old engines—the engines that used to run the express trains before the Baldwin engines arrived. We used the 304 class for the Newcastle express on some occasions, and we always use the 255 class, which is a two-wheeled couple engine for the Melbourne express.

7762. Then, as a matter of fact, when the Baldwin engines, after being laid up for repairs to the axles, were put in running order again, there was no necessity to use them for express purposes because you had other engines in the service sufficiently powerful for the work, and the Baldwin engines were put on ordinary passenger and goods traffic? Yes.

7763. *Mr. Brown.*] Why are they all used in the West? Well, because it is better to keep one class of engines in one district. When that is done the men whose duty it is to repair them get used to one particular kind of engine, and they work more efficiently and more economically than as though they were engaged in repairing a number of types. The drivers and firemen also get used to a certain class of engines, and they do their work better.

7764. *Mr. Fehon.*] Yes, but as a matter of fact, the Baldwin engines are used in the West because it is the Mountain line and there is the heaviest work to be done upon it.

7765. *Mr. Hoyle.*] They did run the Southern express at one time, did they not? Yes; as far as Goulburn.

7766. It must have been as far as Junee, because we had evidence of a broken axle at Junee, you remember that? Yes, I remember the broken axle, they did run as far as Junee for a short time.

7767. *Mr. Fehon.*] It was only for a very short time.

7768. *Mr. Hoyle.* (To witness).] And they were taken off the Southern express because of their defective axles? Yes.

7769. *Mr. Fehon* (to Witness).] Is it not a fact that they used a push-up engine on the mountains for years before the Baldwin engines were thought of? Yes.

7770. *Professor Warren.*] I want to ask Mr. Thow a few questions. The English engines that you have been referring to draw from 130 to 192 tons, do they not? We have had an engine (English) in evidence to some extent, and I wish to get a few particulars about it from you? I can give you the loads of the engines if you like.

7771. Give me the biggest load on the Picton incline and also the speed? From Picton to Mittagong is one section, and the load on the mail trains is eight and a quarter carriages.

7772. That is eight and a quarter times twenty? Yes; and the load on the express trains is seven and a quarter, and at times if the trains are unusually heavy we take eight and a quarter—that is up the Picton incline. We take the same load with the express as we do with the mails if occasion requires that we should; but we ask the traffic people to keep the load on the express down to seven and a quarter if they possibly can. At the same time there is foot-note in this load table that permits them to load the express up to the weight of the mail train if necessary, provided that they give us a little more time to do the work.

7773. Something has been said about the speed that these engines have on the inclines; I suppose you must know something about what the English engines do with this load of 178 tons. What speed will an English engine come up the Picton incline with that load? We have never made any experiment, so I am not able to give you any valuable evidence on that point.

7774. Can you give me any figures that will enable me to get at the horse-power of the English engines? No, we have not made any experiments in that direction.

7775. You say that the draw gear is limited to the hauling of 10 tons? Yes.

7776. So that your draw-gear is now, I think, four to five times as strong as your strain ever can be? I was speaking generally with regard to the draw-gear.

7777. What factor of safety have you got in your draw-gear? It is quite six in the draw-gear on the engines, and four and a half to five in the other vehicles.

7778. How many types of engines have you in use which you propose to continue to use; of course, we understand that you are endeavouring to gradually reduce the number of types of engines on the line? We have eighteen types of engines in use that we intend to continue. That includes the new Baldwin engines.

7779. You would call the new Baldwin engines three types, I suppose—that is to say, Baldwin passenger engines, Baldwin goods engines, and compound engines? No, we call the Baldwin engines two types.

7780. But how do you account for the compound engines? I do not consider that to be a special type; indeed, there is nothing special about it, except the cylinder and the side-bars.

7781. Then you classify them in the same type as the passenger engines, I suppose? No, we classify with the goods engines.

7782. You intend to keep them for running the goods trains then? Yes.

7783-4. When you stated the Baldwin engines did more work than English engines you merely meant that they were more powerful, I take it? Yes; they are so constructed as to do more work, because of their greater size.

7785. You did not intend to institute a comparison between an English engine and an American engine? No; I merely meant that they are fitted for heavier work by reason of their larger cylinder and larger heating service.

7786-7. With regard to the trials that we made the other day, I am very sorry that I have not a copy of the results with me. I know that they are printed, but I would like to have it to refer to now. I am referring of course to the report of Mr. Kidd and Mr. Pollock; but as a matter of fact they would have to come here, or one of them at all events. Still, before then I should like to have gone over the results with you and ask you a few questions upon them.

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7788. *Mr. Hoyle.*] If you want a copy of the report of Mr. Kidd and Mr. Pollock on the trial made the other Sunday with the Baldwin engines, I can let you have it. I have it beside me. It was read by Mr. Eddy in the course of his evidence the other day.

7789. *Professor Warren.*] That is only a preliminary report. The report is very much longer. I saw it printed in Mr. McLachlan's hands yesterday, and should very much like to have it before me now.

7790. *To Witness.*] I notice that in taking these tests the average speed up the incline is given;—does that not include the inertia of the engine when it begins to make the ascent? Yes; in these particular tests that would be the case, because the speed was pretty high after leaving Picton, and then it began to fall as the engine settled down to her work.

7791. So that if we were to calculate the horse-power for the first quarter of a mile or so, that would be altogether misleading? As regards the power of the engine, I think it would.

7792. It would depend upon how much work you got on the incline? Yes.

7793. In fact, you may get a very large apparent horse-power out of some very ordinary engine by making the test in that way? Yes; the only way the horse-power of an engine could be tested would be by taking the area of the indicated diagrams after the engine had settled down to her work, and computing the speed of the wheels. If that were not done, it would be like trying to weigh a body in a scale, and pushing the scale up and down.

7794. Of course I do not want to alter any of the figures in the report. The speed up the incline is rightly recorded; but when the horse-power is put on I think it should be as you say, after the engine has settled down to her work, and then that should be put against the indicated diagrams, which correspond with the mileage on the wheel, and thus show what the engine is doing? It is not done here.

7795. You do not consider the defects in the wheels are flaws? I do not say that I would regard them as absolute fractures.

7796. Here is a report by Mr. Robertson, Mr. Stanger, and Mr. Neale, relating to tests with the new American engine. This of course is before the trial, and I think it looks like the report that Mr. Stranger handed to me when he was giving his evidence. It is the report of the test made with the Baldwin passenger and Consolidation engines. Do you remember that? Yes; I think I have seen that.

7797. Have you considered the results as shown by these figures. I do not consider the table at all complete. It lacks one very important column, and that is horse-power. Did you calculate the horse-power when these tests were made? It can be done from the speeds, if the speeds are given there, provided that they are correct.

7798. I take it that you are anxious to find out what work has been done by all the engines in the service and of course the only way in which you can do that is by taking the horse-power? Yes; we like to know what each class of engine is doing, and I generally run out the horse-power.

7799. *Mr. Fehon.*] As a matter of practice, Professor Warren, we do not bother about horse-power. It does not matter to us what the horse-power of an engine is if she is doing her work well, and all that we calculate is the work done.

7800. *Professor Warren.*] That is all very well for the Railway Commissioners; but it would not be at all satisfactory to the Chief Mechanical Engineer. No doubt it is enough for the Commissioners to know that the engines are doing their work well; but it is necessary for a gentleman in Mr. Thow's position as he has just admitted, to know the horse-power which the engine is capable of developing under given conditions.

7801. *To Witness.*] You would not consider it a fair test of an engine unless the horse-power was given, would you? I always consider the horse-power an important factor in a test. For instance, if I wanted to compare the work done by an engine at one time with the work done by another engine at another time, each perhaps drawing a different load, it would be absolutely necessary for me to work them both out to horse-power. The work done by the two engines must be reduced to a common denominator, otherwise it might be made to appear as if one engine with a very small load behind her was doing more work than an engine with a very much heavier load.

7802. Exactly; your answer implies that it is impossible to form an exact estimate of what the engines are doing, unless you have a basis of comparison, and that you have to get by obtaining the horse-power? That, of course, depends entirely upon the point of view which you consider most important. It might be of the greatest possible importance in railway working to clear a station-yard of waggons. It might be much more important to clear a station-yard of waggons than to clear it at a great pace. If you could only get the waggons out of the station-yard, it might matter very little if they are cleared out at a high rate of speed or at a low rate of speed, and, therefore, horse-power does not come into consideration in such a matter.

7803. But in ordinary traffic it does? Yes, that is another thing altogether; there I should certainly consider the horse-power an important factor in calculating the work done by an engine.

7804. I was not thinking about the taking of waggons out of the yard, I was thinking about the hauling of a train up a grade, and in that you say the horse-power is an all important element;—have you worked out the horse-power in these tests—there are six of them made with Baldwin passenger engines and Baldwin Consolidation goods engines? It is the first time that I have seen that particular paper.

7805. Do you know what horse-power these engines are supposed to develop? Which engines are you referring to, the passenger or the Consolidation engines.

7806. The passenger engines? I know there are statements before they were put into use, but I do not remember the exact result.

7807. But do you know what they were supposed to exert;—do you remember what they were supposed to do in the correspondence that passed between the Railway Commissioners and the Baldwin Locomotive Company? No, I do not.

7808. *Mr. Fehon.*] I do not think that horse-power was once mentioned in the whole of that correspondence.

7809. *Professor Warren.*] I think that speed and weight and gradient are mentioned, so that although you may not have asked for the horse-power in so many words, you did the same thing in another way.

7810. *Mr. Fehon.*] No, we did not; we certified the size of the boilers, the wheels and the cylinder, and various more or less important details, but said nothing about horse-power.

7811. *Professor Warren (to Witness).*] You have read the correspondence between the Railway Commissioners and the Baldwin Locomotive Company, I suppose, Mr. Thow? I have read some of it, but I do not know whether I have read what you are referring to.

7812. Do you know the horse-power which these engines are supposed to exert? No, I could not tell you.

7813. Do you know the horse-power that they do actually exert? No, I do not.

7814. But surely you have thought of this matter? I can tell you approximately from calculations as to what they did on the Sunday that we made the trials on the southern line.

7815. We know that they did excellent work on that occasion, and we want to find out whether they are doing what it was intended that they should do? Well, we have a record of the work that they did, and we know that it was thoroughly satisfactory.

7816. It would be much better to have the actual horse-power stated in evidence by the Chief Mechanical Engineer than a bare statement that the engine performed its work satisfactorily. What it says in the correspondence is this: "It is proposed to haul with this engine trains weighing 152 gross tons (340,500 lb.), up long grades of 130 feet per mile. This would be the usual train, and we expect it to be hauled up this grade at about 22 miles per hour. Occasionally the train would have an additional car, making the load without engine and tender 178 tons, or 394,240 lb. These loads include a full complement of passengers, mail, and baggage." So you have here a maximum load of 178 tons up a grade of 1 in 40 at 22 miles an hour. That is specified in the letter written by Mr. McLachlan to the Baldwin Company, on the 22nd of September, 1890. Is that not quite as good as if you had the horse-power stated in so many words?

7817. *Mr. Fehon.*] You must not forget, Professor Warren, that in answer to that letter the Baldwin Company said that they could not guarantee that speed.

7818. *Professor Warren.*] They said they could not guarantee the speed because it depended on certain other things. They also say this, that they could not guarantee the speed because of the reductions in the weight on the driving-wheels. What they say is this:—"The proposed reduction of weight per axle will, we fear, cause disappointment in the performance of the engines. We judge the same work is expected of them as that stated in the *Railroad Gazette* as being performed by the Baltimore and Ohio engines. It should be fully understood that their efficiency will be correspondingly reduced. As we understand that the permanent-way of the New South Wales railway is of a much more substantial character than the Baltimore and Ohio railroad, we see no reason why the engines built for the latter could not be adopted entire. We should be gratified if, on further consideration, this could be decided upon."

7819. *Mr. Fehon.*] And we accepted the engines on this understauding, and therefore our original estimate falls to the ground altogether.

7820. *Professor Warren.*] I do not think it does. The only difference between your original specification and the engines that you have received is that the engines sent out to you have less weight on the driving-wheel; but surely it does not follow that because they reduce the weight on the driving-wheel, although it was done at your request, and they said, "that they feared it might cause disappointment in the performance of the engines," that therefore the engines should do nothing.

7821. *Mr. Fehon.*] We reduced the width over the cylinder, and also the weight on the driving-wheels, and made various other alterations, and in consequence of that the Baldwin Company wrote to say that they could not guarantee that the engines would perform the work as far as speed is concerned, that we said that they would be required to perform in the first letter we wrote to them, and that is why I say that the original specification falls to the ground.

7822. *Professor Warren.*] That is a matter of opinion. I do not think that it does. It seems to me that in that first letter you stated distinctly what it was that you expected the engines to do, and, apart from that letter, we have no guide as to what your expectations were. In a subsequent letter the Baldwin Company say:—"We have carefully considered the conditions of service for which these locomotives are intended, namely, to haul from 150 to 176 gross tons of cars and load at a speed of 22 miles per hour, up long grades of 136 feet per mile, combined with severe curvature, and to haul, up grades of 176 feet per mile with easier curvature, loads of 120 to 144 gross tons. We note that the shortest curves are 538 feet radius, but it is not stated that this is the radius of the curves in combination with the 130 feet grade. Our calculations indicate that the engines will have sufficient tractive force to haul these loads, but we prefer not to make a definite guarantee of the speed, as it is more or less dependent upon conditions of which we are not fully informed, such as the quality of the coal, the wheel-base of the rolling-stock, condition of track, &c." That is the point. They do not guarantee the speed, because they are not informed of these things; but the next line in the letter shows that, although they do not guarantee the speed, they anticipate that the work will be done at the speed you expect it to be done, and they give as an example the performance of a Baltimore and Ohio engine in daily service on one of their own lines. They say that the maximum load taken up a 17-mile grade is about 214 nett tons, and that the speed is 22 miles per hour. They say that there is much curvature on the 117-ft. grade, and that they are informed that in some places the actual grade considerably exceeds 117 feet per mile. "The B. and O. locomotives," they add, "have a total heating surface of 1,945 square feet, whilst the heating surface of the proposed locomotives as per specification number 5,231 is 1,937 square feet. From these data you can readily judge as to the power and speed of the new engines."

7823. *Mr. Fehon.*] It was quite experimental. They altered the engines to accommodate us, and they sent them out, not knowing exactly, and not guaranteeing what speed they would travel.

7824. *Mr. Brown.*] I can quite understand that. The fact of the matter is that you wanted to strike the best bargain you could with the Baldwin Company, and in specifying the speed at which you expected the engines to travel, you gave a pretty high figure in your original letter. Then you make a reduction in some of the parts of the engine; and upon considering the effect that that reduction may have upon the performances of the engine, the Baldwin Company say we will not guarantee that they will do the same performances as we would have guaranteed if you had not made the alterations. Upon receiving that letter the Commissioners say, "Well, although we want the engines to do so and so, and you will not guarantee that they will do it, still we shall be glad to take them," and, as a matter of fact, you would have been satisfied if they had done less.

7825. *Mr. Fehon.*] Yes; that is exactly how the matter stands.

7826. *Professor Warren.*] Allow me to quote from a letter written by Mr. McLachlan on the 29th December, 1890, to the Baldwin Locomotive Company. In that letter he says, "We calculate that to take a train up the 130-ft. grade at 22 miles an hour will require about 50 indicated horse-power less than is wanted by the Baltimore and Ohio engine during its maximum work, and as in our weight for the train

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train (176 tons gross, exclusive of engine and tender), we include an ample allowance for the weight of passengers and baggage, we anticipate that the engine will be fully equal to this performance. We should, however, be glad of your confirmation on this point." That is the letter sent by Mr. McLaughlan on behalf of the Railway Commissioners after you had received the letter from the Baldwin Locomotive people to which you refer.

7827. *Mr. Fehon.*] Not after we had received the engines. The engines came here without any stipulation at all from the Baldwin locomotive people, or indeed from us, considering that our original specification was overthrown by the alteration in the parts of the engine.

7828. *Professor Warren.*] But you have been stipulating all along what you expected the engines to do, and in the letter which I have just quoted Mr. McLachlan says, referring to the work done by the Baltimore engine during its maximum performance, "We anticipate that the engine will be fully equal to this performance." Surely that is a stipulation on your part, or at least a very clear indication of what you expect the engine to do.

7829. *Mr. Fehon.*] We expected them to do very much more work than any engines we have had in the Colony before, and I think we have proved that they are doing very much more.

7830. *Professor Warren.*] The Commissioners evidently anticipated that the engines would do what I say, or else why should Mr. McLachlan have written to the Baldwin Locomotive Company on their behalf, saying, "We anticipate that the engines will be fully equal to this performance"?

7831. *Mr. Fehon.*] It takes two sides to make a bargain. The next sentence in Mr. McLachlan's letter reads, "We should, however, be glad of your confirmation on this point." We might have anticipated that the engines would do what you say, but as a matter of fact the Baldwin Company distinctly refused to guarantee the speed, and I do not know what they are doing to this day. All that I do know is that, engine for engine, they are doing more work than we could have expected.

7832. *Professor Warren.*] What I want is to have the horse-power that they are actually exerting worked out. I consider that you clearly indicate the horse-power expected of them by you when you ordered them, and it is only by a comparison between the two that we can find out whether they are performing the work that is expected of them.

7833. *Mr. Fehon.*] We never stipulated what the horse-power was to be in any engine that we imported, either from England or from America.

7834. *Professor Warren.*] But do you not see that horse-power is distinctly implied in what you ask for, when you state the load that the engine will have to draw, and the speed at which you expect it to haul that load?

7835. *Mr. Fehon.*] No. We wanted a particular engine for particular work, quite irrespective of horse-power, and we say that they are doing that work.

7836. *Professor Warren.*] But you will have to prove it; and you can only do that by working out the horse-power that the engines are actually exerting, and comparing that with the horse-power that you stated in your letters you expected them to exert.

7837. *Mr. Brown.*] I think you will have to construe that correspondence much as you will have to construe the correspondence about the axles. The Baldwin Company say they will pay for new axles to replace those of inferior quality sent out with the engines. I maintain, commercially, that they will do nothing of the kind; they will pay for a proportion of them, and you will have to bear the rest of the expense. The Baldwin Company will never pay for the boring of the hole to a larger size, and the other expenses incidental to putting the new axles into the engines.

7838. *Mr. Fehon.*] But we had the money in hand, and we have stopped it.

7839. *Mr. Brown.*] A bird in the hand is worth two in the bush. Do you mean to say that the Baldwin Company have actually paid for this work?

7840. *Mr. Fehon.*] Yes, I do; we have had a settlement with their own representative; they have paid for and settled everything; they have behaved in a most liberal manner; indeed, when they heard of the fault that we had to find with the axle, they voluntarily offered to make them good at their own expense.

7841. *President.*] Then instead of getting less than you anticipated you have, in that case, got more than you expected?

7842. *Professor Warren.*] I want to get this question of the work that was expected of them, and the work they are actually doing, placed upon a fair basis. In your letters to the Baldwin Company we have a certain statement; and what we want now is, to know exactly what the engines are doing. They are evidently doing very good work, but I want to see exactly what they are doing.

7843. (To Witness.) Have you worked out the horse-power represented by 176 tons on a grade of 1 in 40 at 22 miles an hour? Yes, I have worked it out; but I understand that the Baldwin Company did not guarantee any speed.

7844. Yes; but the Railway Commissioners expected that they would haul 176 tons up a grade of 1 in 40 at 22 miles an hour. That is evident from the letters? The speed has everything to do with the question, and if there was no guarantee of speed I do not see how we are to fix the horse-power that they were expected to exert. They did not say the engines would do a certain thing at a certain speed; then I do not see how we can make the comparison of horse-power that you ask for.

7845. What horse-power did they get in the correspondence? That would represent about 1,030 horse-power.

7846. Do you not think it is a little more than that? I do not think so.

7847. Well, we still call it 1,030, but I make it 1,222. Have you taken a load of 176 tons, or a load of 150 tons, as a basis for your calculations? I took 176 tons, plus the weight of the engine and tender, which gives altogether 270 tons.

7848. What is your total resistance? Sixty-five lb. per ton.

7849. And you reckon a speed of 22 miles an hour? Yes.

7850. And you get as a result a horse-power of 1,030? About that.

7851. What was the horse-power taken at the trial—not at the commencement of the grade, but after the engine had settled down to its work? I have not seen the card.

7852. What is the biggest horse-power you got altogether on the grade? It was something over 900, I think. I have not got the card, so that I cannot speak from facts. To the best of my recollection, however, it is about 900.

7853. *Mr. Fehon.*] Perhaps it might expedite matters a little if Professor Warren would leave this question until Mr. Stanger is called. I intend to call him this afternoon, and as he was here at the time the engines

engines were ordered, and, as a matter of fact, prepared the specifications, he knows exactly what was expected of them.

7854. *President.*] As far as the question of what was expected of the engines is concerned, that cannot be gathered from these documents, because one thing was said by the Baldwin Company, and another thing by the Railway Commissioners, so that what we have to do is to determine broadly what work was expected of the engines. Professor Warren's point is this: That, in the first place, you wrote for engines capable of hauling 176 tons up a grade of 1 in 40 at the rate of 22 miles an hour, and that after you received the letter from the Baldwin Company, in which they said that owing to the alterations you had made in the engines they would not guarantee the speed. Mr. McLachlan, on behalf of the Railway Commissioners, said, "We calculate that to take a train up the 130-ft. grades at 22 miles an hour will require about 50 indicated horse-power less than is wanted by the Baltimore and Ohio engines during its maximum work, and as in our weight for the train (176 tons gross, exclusive of the engine and tender), we include an ample allowance for the weight of passengers and baggage, we anticipate that the engine will be fully equal to this performance." That is what Professor Warren says was expected of these engines, or rather he takes that as one of the elements of your expectations. The question for us is to consider whether that is actually what you expected, or whether you were simply trying to get the best you could from the company, and, in order to do that, stating more than you really expected to get.

7855. *Professor Warren.*] Well, if they had put it in that way, I should not have pressed the matter, but they have brought forward no evidence at all to show that they did not expect the engines to do all that was expected in the correspondence.

7856. *Mr. Fehon.*] You must not forget that the engines were ordered in a very great hurry.

7857. *President.*] Well, I am only putting my own views of the question before you. It seems to me that it is quite possible that as business people—for in this respect the Commissioners were acting as business people as well as the Baldwin Company—you were each trying to get as much as you could, and that there was no actual contract entered into.

7858. *Professor Warren.*] Is Mr. Stanger to be called?

7859. *Mr. Fehon.*] Yes; we will call him after Mr. Thow's evidence is concluded.

7860. *Professor Warren.*] Well, then I shall ask him a number of questions with regard to the tests that have been applied to these engines, and I hope that he will come prepared with figures. It is very unsatisfactory to receive answers couched in general terms.

7861. *Mr. Brown* (to Witness).] What kind of inspection were the engines submitted to after they arrived here? Just the ordinary inspection that an engine would get before being put to work.

7862. These engines were not inspected in America, as the engines built in England are; it was quite understood that they should not be inspected there; indeed, it was thought better that they should not be, and what I want to know is more for the sake of information than anything else—what kind of inspection they received after arriving in the Colony? An engine in process of manufacture is inspected as the parts are being made.

7863. Where is that? Either in England or America—where ever inspection during manufacture is instituted.

7864. But I am speaking now of the inspection to which the Baldwin engines were subjected at the hands of the Railway Commissioners or their officers; what inspection were they subjected to in Sydney? Only the inspection involved in the examination of the different pieces before they were put into their proper places. It was seen that they were alright and sound.

7865. It would only be a cursory examination? Oh, no. The different pieces could be examined in this way: Take the wheels; they were all completed when we got them. We could not see the process by which they were made; we could not see whether the iron that was put into them was clean iron or not, or whether the scrap was properly worked; and the same applies to the axle. We could not tell whether there was any foreign matter in them. All we could do was to judge by appearances, but as far as possible, without actually breaking the iron, we examined them as carefully as we could.

7866. Then, practically, it was not possible to subject them to any other inspection than that involved in looking at them before they were put on the road? Quite so. That was the only inspection that in the nature of things could take place here.

7867. And is that the only inspection that could be given to that kind of work after it arrived? Yes; that is so.

7868. There could not be any other? No.

7869. What is the inspection that is given to engines being built in England by Sir John Fowler? When these things are being manufactured in England, Sir John Fowler or his assistants inspect them when they are in the rough. That is before the machine itself has been made out of the raw material. The inspection that he carries out is an inspection in detail before the parts are finished, and whilst they are being made.

7870. Then would he see the engines tested after they were made? Yes; he would see them tested in the maker's works. He would first of all see the different pieces tested, and then he would see the engines tested in the maker's yard under steam or on rollers. They very frequently test engines on rollers, and consequently the inspection that the Baldwin engines underwent here is similar to the subsequent part of the inspection in England.

7871. So that no matter what kind of examination you had submitted the engines to here, you could not have discovered the defects that subsequently manifested themselves? You could not have discovered them in the course of the examination in the works. They were defects that could only manifest themselves after the engines had once began to run. We saw that there was a roughness about the wheels which we did not like; but after examining them as closely as we possibly could without pulling the wheels to pieces, we saw that there was no actual unsoundness, and satisfied ourselves that the flaws were only apparent flaws—not real ones.

7872. It would not have been a wise thing to have submitted the axles to the drop test, would it? No; I do not think there was anything in their appearance to justify it.

7873. Although it became necessary to do it afterwards? Yes; it did become necessary to test the axles subsequently.

7874. I am speaking about the axles? There was nothing to show any want of soundness about the axles when we examined them before putting the parts together. It was only after the engines had once began to run that the flaws were discoverable.

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7875. How many axles would there be in these thirty locomotives? There were twenty-four axles similar to those that broke, and there are also forty-eight tender axles.

7876. Did they send you any spare axles? No; we had no spare axles. We had duplicate wheels and axles, but no axles alone, except those that were in the locomotives.

7877. Well, would it not have been judicious to have tested one of these at any rate for what it was worth? No; I do not think it was at all required, because we did not suspect that there was any want of soundness or strength about the engines. There was nothing to indicate that there was, and it has not been the practice to test new finished axles as you suggest. Such a thing has never been done.

7878. Did you see Dr. Williams when you were in America? Yes, I did.

7879. Did he say anything to you about the engines that were being ordered by the Railway Commissioners;—did he compare them in any way with the Baltimore and Ohio engines? No.

7880. Had you any conversation with him about it? No; I did not know anything about the Baltimore and Ohio engines at that time.

7881. Did you not know about the alteration in the specification of the engines ordered by the Railway Commissioners, and the fact that the Baldwin Company had recommended that they should have been built from the same model as the Baltimore and Ohio engine? I inquired about the specifications when I went to the works, and they showed me some of the correspondence.

7882. And did they not say anything about the alterations that were being made? No.

7883. They did not refer to the fact that the Railway Commissioners wanted an alteration in the type of engine, and that the Baldwin Company recommended them to take a Baltimore and Ohio engine? No; they did not.

7884. *Mr. Hoyle.*] Were the Consolidation goods engines here before the Beyer and Peacock express engines? I think they were.

7885. Were they running before the Manchester engines arrived? I think some of them were.

7886. But were the twenty in work before the Beyer and Peacock express engines arrived in the Colony? I think they were, but I am not very sure.

7887. Was it very long after the Baldwin express engines began to work that the Beyer and Peacock engines came? You are speaking of the Consolidation engines now, are you not?

7888. Yes? No; not very long after.

7889. There was a loose wheel on engine 456, was there not. That is the engine that the members of the Commission saw when they went to the workshops at Eveleigh. Could not that wheel have been put into the furnace to show whether those roughnesses that you speak of in the wheels were real flaws or only apparent cracks? Yes; no doubt it could have been put into the furnace, but, as a matter of fact, we want to use the wheel again, and do not wish to injure it.

7890. It would not have hurt it at all, and it would have been just as well to make perfectly sure? Yes; I think it might have hurt it. At all events, I do not think it would be a wise thing to do. If it were a wheel that we did not want to use again we might have done it, but, as a matter of fact, if the spokes are going they will show it. I have no doubt you are aware that we often have spokes broken on the wheels of engines. I have seen an engine with three or four spokes broken in one wheel, and there has been no risk whatever. It is not at all an uncommon thing for the spokes of wheels to crack. You hear them jingle just as you hear the wheel of a car or a buggy jingle if its spokes were broken. There are scores of locomotives running that way.

7891. Do you not take them out when they are running like that? No.

7892. *Mr. Brown.*] I know there are not scores of buggies running like that. If the spokes of a buggy wheel break we soon get them repaired? Unless there are a large number of spokes broken in one wheel we never think of throwing the wheel away.

7893. *Mr. Hoyle.*] Yes; but in that engine, No. 447, more than two-thirds of the spokes in the wheel appear to be cracked. Supposing that the tire of that wheel was to break if the spokes are really cracked as they certainly appear to be, would there not be a liability of their giving way? No; I do not apprehend any danger whatever, because I do not think those are cracks. The marks that you see are fins. When the iron is in a molten state, and being pressed into a mould, a thin film always squeezes over the colder parts of the wheel, and that is exactly what has taken place there. Those apparent cracks that you saw are simply thin films of iron squeezed over the spokes of the wheel.

7894. *Mr. Hoyle.*] At all events one or two of them sounded decidedly bad when they tried them with the hammer.

7895. *President (to Witness).*] The thin film, looking as though you could dig a knife into it is what you call a fin? Yes; that is the technical name given to the thin pieces of iron which overlap the spokes in some cases, but I do not think for a moment that these could be regarded as broken spokes—not at present, at all events.

7896. *Mr. Hoyle.*] Would they not be liable to break sooner than the ordinary English spokes? That I cannot say. I have not had any experience of these wheels, and there is one thing that must be regarded as a set-off to the roughness of manufacture. The English wheel, although it may be stronger, is built in various pieces, whilst these wheels are made of rolled bars. They are continuous, and as rolled bars the spokes would no doubt be stronger per square inch of section than as though they were built up, as is done in the case of English wheels, and therefore I should not be surprised to find that as a matter of fact they will last very well although they are light.

7897. Can you give us the height of the Baldwin engine from the rail to the top of the cab. *Mr. Gregory's* report states that the measurement from the rail to the top of the gauge on the cab is 12 ft. 6 in., whilst that shown on the sketch put in evidence by the Railway Commissioners is 12 ft. 3 in.;—would that be the distance from the rail to the widest portion of the cab—12 ft. 6 in.? I have not the dimensions with me so I cannot say, but I will get them for you, and send them to you.

7898. Thank you; you see, in this case *Mr. Eddy* put in a diagram of a Mann car, to show that we had a vehicle wider than the cab of the Baldwin engines on the line before the Baldwin engines arrived, but I maintain that whether it would foul the structures on the stations or not depends entirely on the height of its widest point from the rail. The cab of a Baldwin engine may foul a structure by reason of its being higher than the Mann car. The height of the widest portion of the rail of the Mann car is 9 ft. 6 $\frac{3}{4}$ inches, and the cab of a Baldwin engine is 9 feet 5 $\frac{3}{4}$ inches; but according to *Mr. Gregory's* report the widest point of the Baldwin engine would be 12 feet 6 inches from the top of the rail, whereas the

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Mann car is only 11 feet and $\frac{7}{8}$ inch. Therefore the Mann car, although wider, would go clear of the structure, whereas the cab of a Baldwin engine, being higher, might foul the structure, so that there is really no analogy between the two. The statement that Mr. Eddy made with regard to a vehicle wider than the Baldwin engines running clear of the structures before they were altered is nothing more than a broad assertion without any point in it? I cannot give you any information upon the point at present.

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7899. Can you tell me whether this [*producing a diagram of engine 132, class J*], was the widest engine you had in the service before the Baldwin engine came? Yes.

7900. And that engine is wider over the cylinders than a Baldwin engine. According to the measurement it is not;—will you give me the measurement? Nine feet three and a half inches.

7901. The measurement of a Baldwin engine is 9 feet 4 $\frac{3}{4}$ inches? Yes; but that measurement is taken from the altered dimensions. They were to be within those dimensions.

7902. Nine feet three inches? The drawing shows 9 feet 3 inches, so that the engine ought to be within that dimension.

7903. And the engines to which you have just referred (No. 132, class J.), have been running on the western road for many years. They are 9 feet 3 $\frac{1}{2}$ inches according to their drawing dimensions, but this 9 feet 4 inches is a variation due to the workshops, and not to designs? Quite so; but it is a variation all the same.

7904. Can you tell me whether this engine carries her cylinders higher than that? The cylinders in the passenger engine will be higher than these, but in the consolidation goods engine they are about the same level. Perhaps the new Consolidation engines may be a little lower in the cylinders.

7905. *Mr. Brown.*] What is the value in money of one of these axles—say, a tender axle? About £7.

7906. And of a driving axle? The driving axles have not given any trouble to us.

7907. No; but I am only asking for my own information. I wanted to know what was about their commercial value? The driving axle would be worth about £24 or £25 when put into the wheel.

7908. *Mr. Hoyle.*] The Baldwin engines were narrower in the cab, I presume? I think they would have a smaller cab on the J class.

7909. I notice here, by Mr. Robertson's report, that the cab of a Baldwin engine fouls several times in the coal-stages, particularly against the Bathurst coal-stage. Mr. Robinson showed where the cab fouled, so I suppose it must be lower than the cabs of the other engines? Yes; it is a smaller cab.

Charles Hursthouse Stanger recalled:—

7910. *Mr. Fehon*] Mr. Stanger has already stated the position he occupies in the Service. From certain questions asked by Mr. Hoyle during this inquiry, it appears that surprise is experienced in some quarters that the Baldwin passenger engines have required assistance in working the mail and passenger trains between Penrith and Katoomba. Will you kindly tell us what the facts are? Well, I never expected that the Baldwin passenger engine would work the mail between Penrith and Katoomba without assistance. I never expected that she would take over a load of 124 tons up the mountain grades, and I knew that the mail would never be kept down to that load. The minimum weight of the Western mail-train, as it is now made up, is about 140 tons.

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7911. *Professor Warren.*] One hundred and forty tons you say? Yes.

7912. You are sure of it, I suppose? Yes; though I should not like to be bound by a cwt. or two; but I know it is approximately that.

7913. It is not 144 tons, is it? Oh, no; certainly not. One hundred and forty tons represent the minimum train that we can run as the Western mail, I always thought that we should have to assist the mail-trains to Katoomba every night.

7914. *Mr. Fehon.*] You were one of the officers who advised the Commissioners in regard to the ordering of these Baldwin engines, were you not? Yes.

7915. You know the conditions that were first of all put before the Baldwin Company. In those conditions we stated that we expected the engines to do a certain thing? Yes.

7916. And are they really doing that? Yes.

7917. *President.*] What did you expect them to do?

7918. Have your expectations been fulfilled? Fully.

7919. *President.*] Wait one moment, what did you expect them to do. Let us have that point fairly defined? I only tried to estimate their load for goods trains at slow speed. I did not go very much into the question of their loads at high speeds, but when we first put them into the service on the passenger trains between Sydney and Newcastle, I then tried them with a load of a little over 160 tons.

7920. *Professor Warren.*] On what grades? 1 in 40, and to make time with that train, a man ought to get up the Hawkesbury bank, the most severe grade between here and Newcastle, at certainly not less than 15 miles an hour.

7921. *President.*] Have you looked at the correspondence. As I take it, there is no contract whatever between you and the Baldwin Company as to the speed which it is expected these engines will run? No; I understand not.

7922. If you look at the correspondence you will see that you say you expect them to do one thing, and the Baldwin Company write to you to say that, inasmuch as you altered the specifications, they could not guarantee the speed. Subsequently to that, however, you wrote to them saying that you expected them to do a certain thing. It may be that in the letter, in which Mr. McLachlan said, "We calculate that to take a train up the 130-foot grade at 22 miles an hour, will require about 50 indicated horse-power less than is wanted by the Baltimore and Ohio engines during its maximum work, and as in our weight (176 for the train, 176 tons gross, exclusive of engine and tender) we include an ample allowance for the weight of passenger and baggage, we anticipate that the engine will be fully equal to this performance." In that letter, it may be that you were only writing to the Baldwin Company, as business people doing your best to get the most you could for your money, and that whilst you stated that you expected the engines to do this you had calculated upon being satisfied with something less than that. What I want to know is what you actually expected, no matter what you may have said in the course of your correspondence with the Company that you expected?

7923. *Mr. Brown.*] I believe if you ask Mr. Stanger he will tell you that he never saw the letter from which you have just quoted until the correspondence was printed? It is quite true that I did not see the letter

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letter at the time it was written, and was quite ignorant of the fact that it had been sent. I was consulted as to whether the engines should be ordered, and also as to the specifications, and after that I do not recollect seeing any of the papers or having anything to do with the Baldwin Company.

7924. *President.*] Then what do you expect the engines to do?

7925. *Professor Warren.*] 160 tons he said.

7926. *Mr. Brown.*] That is what he told them when they were ordering the engines, but as a matter of fact what did you expect them to do Mr. Stanger, at the time you ordered them what did you think they would do? I thought they would take 196 tons up 1 in 40 at the rate of 15 miles an hour.

7927. *Mr. Fehon.*] Which engine? I am referring to the Baldwin passenger engine.

7928. *President.*] Will they do that? I think so.

7929. *Professor Warren.*] Mr. Stanger did not order the engines, we must remember that it was the Commissioners who ordered the engines, and therefore it was not what Mr. Stanger expected them to do but what the Commissioners expected.

7930. *President.*] Exactly, but entirely in consequence of a report by Mr. Stanger;—subsequently the Secretary wrote to the Baldwin Company without consulting Mr. Stanger, and we know what was stated in that letter, but what I want to find out now is what Mr. Stanger, as the person who put the Commissioners in motion expected? Well, I expected them as I have just said to take 196 tons up 1 in 40 at a speed of 15 miles an hour. I expected a tractive power of a little over 19,433, but I then had to assume the pressure on the cylinders.

7931. *Professor Warren.*] What did you assume as the pressure on the cylinders? I assumed it at 128.

7932. That is the mean pressure on the cylinders? That is what I assumed. I am not quite sure of the exact figures, I have not got my note-book with me.

7933. Of course you assume that you had a full load, and were giving the engine as much pressure as you could? Yes.

7934. *Mr. Fehon.*] Have your expectations been fulfilled by the performance of these engines? Quite, in fact I think the passenger engines are taking a larger load than I expected they would be. I first of all thought they would take 124 tons, but we have since made them take 132 tons as a regular load, and if on a fine day a driver told me that he could take more than that load without an assistant engine I should have no hesitation in letting him do so. I would be quite willing to let a driver try an extra 8 tons over the mountain grades.

7935. You use a Consolidation engine on the mail-train, and that is the result of a recent idea, and is intended to avoid assistant mileage, and not at all because you were disappointed in the Baldwin passenger engines not taking the mail without assistance? Yes.

7936. What was your object in using a goods engine? It was done with the idea of saving assistant mileage with the mail-trains to the extent of about 10,000 miles a year, and light return mileage to the same extent, or in other words with the idea of saving 20,000 useless engine miles in every year. I made the proposal and felt perfectly certain that it would answer, because the speed of the mail-train is necessarily slow up the steep grades to Katoomba. I was allowed a trial, and I think it has been very successful. We are now taking the very heavy mail-trains up without assistance.

7937. It was not that you were disappointed with the Baldwin passenger engines? No; I have already said that I did not expect the Baldwin passenger engine to take more than 124 tons. I think that the report that I addressed to Mr. Thow explained distinctly that the chief object I had in view was the saving of so much unnecessary mileage.

7938. And the assistant engine usually returns from Katoomba light? Yes.

7939. Why is that? That is inevitable. We must of necessity have some engines running light from Katoomba to Penrith, because an engine can bring a much heavier load back to Penrith than it can take from Penrith to Katoomba.

7940. One of the witnesses, Driver Gasgoine, was asked if there was not a special quality of coal kept at Penrith for the Consolidation engines. What are the facts? It is a fact to some extent; but I think that Gasgoine would have been fairer if he had said that the special quality of coal was kept for the mail-trains.

7941. *Professor Warren.*] He did say that as a matter of fact, I remember that he said although he drove a Consolidation engine himself he did not get the special coal and would like to get it.

7942. *Witness.*] Well, as a matter of fact we have abandoned that arrangement, because now the mail Consolidation engine uses mountain coal for the mail-train—the best mountain coal it is true, but not the rich southern coal.

7943. Has the working of the Consolidation engine on the mail-train been satisfactory? I should like here to make a statement giving a history of the mail working between Penrith and Dubbo. Before the Baldwin passenger engines came into use, the maximum load for one engine on the passenger trains, between Penrith and Katoomba was equal to 104 tons, and even this load on the mail-train had to be reduced to 96 tons just before last Christmas, owing to the 436 class engines not being in very good condition. Excepting when the mail-train was divided and run in two divisions from Penrith, the 436 class engines invariably required assistance from Penrith to Katoomba, and when the load exceeded 130 tons, which was of frequent occurrence, a pilot engine had to go on to Wallerawang. This was a very expensive matter owing to the difficulty in getting a return load for the engines. Occasionally the pilot engine had to go on to Bathurst, and then unless the load could be reduced at Bathurst station an assistant engine was required to assist the train from Bathurst to Dubbo. The load for this class of engine from Katoomba to Dubbo being the same. For the up journey from Dubbo, the locomotive foreman, at Dubbo, had always to be prepared with an assistant engine in case the load exceeded equal to about 130 tons. The same applied to Bathurst. At Wallerawang the liability to require an assistant engine was so great that both men and engines had to be provided and held in readiness until the mail-train had gone past, in case it was required to assist the mail to Clarence siding. All of this is now done away with since we have had the larger engines to use for the mail service. I do not know any case in which we have assisted the larger engines.

7944. *Mr. Fehon.*] Has there been any instance in which the Consolidation engine, for some reason or other, was prevented from joining its train and two other engines had to take the mail? A Consolidation engine failed one night. There was a slight mishap when it was coming out of the shed yard, there was a load that night of about 143 tons, and as the Consolidation engine was not available we had to put on

on two of the 304 class Mogul engines, and those two engines lost time. I feel confident in my own mind that if the Consolidation engine had been running the train instead of losing time it would have made time with that load. It is true that they had to make an extra stop at Wentworth Falls, but apart from that the two engines made a loss of ten minutes.

7945. Then as a matter of fact you believe that a Consolidation engine would not only have kept time, but would have made time with that load? Yes, I think so. The time allowed between Penrith and Katoomba is much less than it was a year ago, and I think we send a heavy train away with the Consolidation engine with more likelihood of its reaching Katoomba to time than if we were using two engines.

7946. In questions to Mr. Howe, Nos. 1129, 1130, and 1132, of the printed evidence, Mr. Hoyle refers to the fact that the wheels of some of the passenger engines having to be put in the lathe to be turned up shortly after the engines commenced to run, and asked if it were due to any failure of the brake-gear or to carelessness on the part of the drivers. What are the facts? That was not owing to a failure of the brake gear. The engine had to have the large coupled wheels taken out and put into the lathe. The fact was, that the driver had to do something to avert a collision. He allowed his train to go into the station too fast, and seeing something ahead of him was obliged to put the brakes on, and I think apply the reversing-gear and that made the wheels skid.

7947. And of course produced a flat place on the tires? Yes. The man did the proper thing under the circumstances only that he should not have allowed his engine to run into the station so fast.

7948. What was the practice when the Commissioners took office with regard to working heavy trains, when although not sufficient to make two trains the load was beyond the power of one engine, and when a portion could not be left for a considerable time, such traffic as for instance live stock? We were not allowed to make up a train of more than 50 per cent. above one engine's load; that is to say, that two engines would have to take a train with only a load equal to one and a-half of the engine-power, and that, of course, meant a great deal of waste in engine-power, particularly in the case of live stock. What I mean is this, if there were forty trucks to be moved, and that represented the power of two engines, we would only be allowed to haul thirty with the two engines.

7949. And has the use of the Baldwin engines entirely remedied that defect? Yes, before we got the Baldwin engines, the Chief Commissioner was, I think it must have been, so disgusted at seeing the number of small trains that were going along one night that when I explained to him on one of the Western tours that we were prohibited putting more than 50 per cent. of the assistant engine's power into a train he consulted with Mr. Kirkealdie as to whether we could not put a double load on. I demurred a little at first, because I thought that with the slack couplings there would be a difficulty in doing so, but it was ultimately decided that if the combined power of the two engines was forty, we might put thirty-seven on, and that the couplings should always be screw connections when that was done. The result was, in my opinion, very successful as an expedient until we got the large Baldwin engines, which take almost the double load. The double load is twenty-six of sheep and two brake vans. The Baldwin engines take twenty-five of sheep and two brake vans.

7950. You stated in your evidence, when called by Mr. Hoyle, that you considered the Baldwin engines, which are the subject of this inquiry, compare favourably as regards the cost of repairs with other American engines that you have had experience of;—how do they compare as regards failures on the road? I have made a short return in regard to that. There is one thing I should like to mention. I intended to have done so when you asked me the last question. That was that I consider that doing away with the two engines, and having one powerful engine, has been a very great improvement in our working as far as brake and draw-gear goes. When working the trains with two engines we used to have a great many broken couplings between the two engines. Now that we have only one engine that is done away with. Then again, I think that one driver taking control of the whole train is likely to be more careful in handling the train than two drivers with two engines can possibly be.

7951. Of course it conduces to economy of working the traffic? It must be a very great advantage to the traffic in that respect. About these failures I have taken from our monthly returns for the last three months particulars with regard to the failures in the best used American engines—the 304 class engine, built by the Baldwin Co., and known as the Mogul engine, the improved 304 class engine, built by Dubs and Co., and the 446 "O" class engines, built by the Baldwin Co. From these returns I get the following facts:—That the ten Baldwin engines of the 304 class "L" show an average for the last three months of one failure for every 4,466 miles run; ten Dubs engines "L" 4,366 class show an average for the three months of one failure for every 3,076 miles run; and the twelve Baldwin engines of "O" 446 class show an average for the three months of one failure for every 7,431 miles run. Of course it is fair to say that the Baldwin passenger was a new engine, but on the other hand that has been a reason for the failures in many instances. We blame it for being a new engine. The other engine—the 436 class, built by Dubs & Co., known by the men as the Scotch-Yankees, have been through the shop very recently, and have in consequence, I think, been in very fair order, and I also think that the engines built by the Baldwin Co., and known as the "L" 304 class, have been in very fair order during the last three months. I could have given details with regard to other engines, but as the Scotch Yankees were not in good order, I did not consider it fair to include them in the comparison.

7952. *Professor Warren.*] Do you consider that a fair return? Yes, I do. I have also compared the new Consolidation goods engines, with the old goods engines purchased from the Baldwin Company, and this is what I find. The average in the case of eleven of the old engines for the last three months was one failure for every 3,386 miles, whilst the average in the case of the twenty new Consolidation engines for the three months was one failure for every 7,848 miles. I attribute that to the fact that the new engines are of a better design than the old ones. Of course we have had a large experience, and were satisfied that the new ones would be an improvement.

7953. *Mr. Fehon.*] All the Baldwin engines are in your charge? Yes; with the exception of one, and it is working ballast on the South Coast line.

7954. With that exception, all the Baldwin engines are in your charge? Yes; I think so.

7955. You are in constant communication with the inspectors and drivers who work these engines? Yes.

7956. What is the general opinion as to their suitability for the service they are in? I have never heard anything but great praise of the passenger engines given to them by the driver even at the time when we had serious trouble with the axles breaking. The drivers said that they were sorry to lose them and.

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and would be glad to have them back again. Since we have put in the axles the drivers like them very well, and speak highly of them. With regard to the goods engines I thought the drivers would not like them so well, but to my surprise they spoke very highly of them. The only one I have heard speak against them is Gascoigne, who was brought here by Mr. Hoyle. I am surprised at that, because I have met him often, and he has said nothing about them to me. I think Gascoigne must have been unfortunate in a few trips and got down-hearted about them. The motion, I think, is less than it would be with a lighter engine.

7957. *President.*] Gascoigne, I think, said that the engines were not good for the health, as they were a little hot? Well, I have ridden with the drivers of the engines, and travelled long distances with them. It is true that they are hot, but then every locomotive is hot on the foot-plate. They are certainly not the coolest engine I have been on; but I do not think they are more hot than the old express engine—the four-wheeled couple.

7958. *President.*] It is part of the driver's contract to live a rather hot life? Yes; he accepts that as part of the conditions.

7959. *Mr. Fehon.*] One of the charges made before this Commission is that "The Baldwin engines are too wide for the platforms;" you have heard what has been said on the subject;—can you give us any information as to whether you have had any difficulty in the past in working other engines on any portions of the line? Yes, I can. It is more than two years ago now since I wished to put the Mogul engine on the Northern mail service at Murrurundi to go on to Werris Creek with a mixed train. I had only just been put in charge of the Northern line, and was rather strange to it, and somebody reminded me that before using wide engines I had better look out for the platforms. Then I got templets made showing the width of the Mogul engine, and sent them up to the inspectors of Newcastle and Murrurundi, asking them to bolt them to the buffer beam of an engine working a slow train, and report to me if they fouled any of the platforms. They were to run them over the line and allow the drivers to measure the distance between the platform and the templet and report to me whether they fouled or not. This was quite early in 1890 I got that report, and the work required seemed to me to be so much that I dropped my intention of using these engines, and made shift with the Vulcan class.

7960. *President.*] You refer to the work of altering the platform? Yes; the Baldwin engines had not been thought of. We expected to get engines from an English syndicate. After the Baldwin engines had been ordered I was asked by the Commissioners to reduce the assistant mileage that was being run with the Northern mail-train. Almost night after night we ran two engines with the mail-train to Werris Creek, and the Commissioners, upon receiving that statement said, "We have powerful engines and ought to use them," and I said that they might be used on the Northern line if the platforms were altered. That was then done, and these engines were used very successfully on the line between Singleton and Werris Creek.

7961. This was in 1890? Yes, it was early in 1890 that I put the templet on. Towards the end of 1890 I sent in a report as to the alterations that would be required. I was compelled to ask for these platforms to be altered. I did not know much about the Richmond line but I was not able to work the American engines which had been imported at that time until some of the platforms had been altered. It is well known that on the Western line the roads were slewed in front of some of the stations. When I went to Wellington in 1884 I saw that the line had been slewed in front of the station 6 inches, and upon making inquiry I was told that it was to make room for the Baldwin engines which were then running.

7962. *Mr. Fehon.*] When was that? In 1884, or rather before that. I think I was stationed there in 1884.

7963. These alterations of platforms have been going on more or less since 1884? Yes, slewing rails and so forth.

7964. From your experience of these engines and from what you have heard do you consider that they are suitable for the permanent ways of New South Wales? Yes, I do. I have heard a great deal of the evidence here. On all the occasions that I have ridden on the engines and when I knew that I was going over roads laid with the lightest rails we have I have not experienced the slightest uneasiness. It never occurred to me that there was a disproportion between the weight of the engines and the rails. I am not a civil engineer and therefore I have not gone into the question of roads in any scientific sense, but as I have stated I never in travelling on these engines felt the slightest fear with regard to their safety. At the same time I should not care to run them at a very high speed on that portion of the road that lies between Newcastle and Maitland, but I do not think we do that as a matter of fact.

7965. *Mr. Hoyle.*] I do not think this statement is of any value whatever. In any comparative statement it is only fair to state what the failures were. You may have a pin falling out or an axle breaking; two very different things in relative importance. There are failures and failures. So far as I am concerned, I think this is a very misleading statement. It would be much better in a statement of this kind to include all the details and as it is I must regard it as a very misleading statement? It is very kind of you Mr. Hoyle to remind me of my omission. I should have said that this statement includes every failure that has caused any delay to the traffic.

7966. I think it ought to be stated what the failure was? One class of failure only has been kept out, and I thought it only fair to keep it out. I refer to failures to keep time owing to bad coal, every other failure that has effected the traffic has been included.

7967. *Mr. Hoyle.*] Quite so, but I think it would be fair to both sides if the particular nature of each failure was stated.

7968. *President.*] Mr. Hoyle says that whether it is the breaking of the reversing-gear, draw-gear, axle, or anything else, it should be stated in detail.

7969. *Witness.*] I meant to say that the statement included everything that happened to the engines, such as the breaking of axles and everything else.

7970. *Mr. Hoyle.*] Mr. Thow, who vacated that chair just before you took it said that the "Scotch Yankee" engines were giving no trouble? Neither are they at the present time.

7971. You have compiled a statement in the last three months, and by that statement you show that these engines are really giving more trouble than the Baldwin? During the last month they have not given much trouble. We have put them through the shops and they do their work very well.

7972. *Professor Warren.*] Mr. Thow said that a great deal of money had been spent on these engines? Yes, and it is since the money has been spent upon them that they have given no trouble.

7973. *President.*] That is evidently so.

7974. *Mr. Hoyle.*] What I complain of is that in a statement purporting to be a comparison of the various engines certain details have been given in one case and not in another? You cannot complain of that in this instance, because everything is given, each class of engines have been treated alike.

7975. *Mr. Thow* has already promised to submit an amended return with these details, and to put in the figures we require in regard to these statements, stating what the repairs were, and how they have happened.

7976. *Professor Warren.*] I did not understand him to say, that I think he said he might do so. I do not know whether he will or not.

7977. *Mr. Fehon.*] I think it comes back to what I said before. Only failures of construction should be considered by the Commission. If there are faults in construction, let them be given by all means. Such details as Mr. Hoyle talks of—hot-boxes, &c.—will happen anywhere; if there are errors of construction, well, let me know, but it is useless spending time by going into petty details of this kind.

7978. *President.*] Surely if the more important things were set out Mr. Hoyle would be satisfied. Engines, I understand, go into the workshops for all sorts of little things.

7979. *Mr. Hoyle.*] No; there is the distinction; small repairs are attended to in the running-shops between the trips of the engines. They only go into the workshops for important repairs; the workshop repairs are comprehensive repairs.

7980. *President.*] You want to show, Mr. Hoyle, that there are repairs necessitated by defective designs; will it answer your purpose if you have a statement of all repairs that have been necessitated by defective design?

7981. *Mr. Hoyle.*] Yes; and of failures which ought not to occur in engines so new as these are.

7982. It says distinctly in the charge, "failures of construction."

7983. *President.*] Surely it would be enough for Mr. Hoyle if he got that. I mean the statement I have referred to. If we keep on multiplying the arguments it will be interminable.

7984. *Mr. Hoyle.*] I only want one report, and that is to be comprehensive. If it is to be a comparative statement, let it be one giving the details in each case.

7985. *Mr. Fehon.*] I do not see any necessity for a comparative report; why should we have one?

7986. There is nothing in making a comparative report which will give you no information; why compare the "Scotch Yankees" or others with any other class of engine; it will lead to no decision.

7987. *Mr. Hoyle.*] Well, if it is a mistake it is one of your own department.

7988. *Mr. Fehon.*] Very well, then, we will withdraw the statement.

7989. *Witness.*] The reason why we made this comparative statement was that when I was previously examined I told Mr. Hoyle that these engines did not give us any more trouble than other American engines we have had; that is why I supplied this comparative statement. Every failure is noted in that list that caused a stoppage of the traffic, because the stoppage in the traffic had necessitated a loss of time. Every failure, whether great or small, is entered there.

7990. *Mr. Brown.*] I understand that Mr. Hoyle is dissatisfied with the report; suppose we let it be left out altogether.

7991. *President.*] Very well, then, we won't have it put in evidence unless you want it put in Mr. Hoyle; shall we leave it out altogether?

7992. *Mr. Hoyle.*] I do not want it in that form; it will be very much more satisfactory to have it inclusive of the cause of the failure, but as I say, I did not ask for it.

7993. *Witness.*] As I have said before, I only drew up this statement because I thought I had committed myself to certain facts when last examined, and I was desirous of doing what I could to substantiate those statements.

7994. *Professor Warren.*] You want a statement of repairs to be put in.

7995. *Mr. Fehon.*] I do not think it is at all necessary.

7996. *Mr. Brown.*] But I am afraid they have already decided that it should be supplied.

7997. *Mr. Fehon.*] I do not object to a statement of that kind being made, and it was only with the idea of shortening the inquiry that I spoke.

7998. *Mr. Hoyle.*] I do not think I can ask Mr. Stanger any more questions.

7999. *Professor Warren.*] You say that you took a load of 195 tons at a rate of 15 miles an hour as a basis of your test. Of course you have not read the correspondence—I mean you only saw it in this room, and not before? Yes.

FRIDAY, 27 MAY, 1892.

[The Commission met in the Board-room, Colonial Secretary's Office, at 2 p.m.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E. | ALEXANDER BROWN, Esq., M.L.C., J.P.

8000. *Mr. Fehon.*] Mr. Thow, who made a slight mistake in his evidence yesterday with reference to the tests which took place in connection with the rail broken at Tarana, wishes to correct what he stated. He is present. Will the Commission permit him to make the correction he desires?

8001. *President.*] Certainly.

William Thow recalled:—

8002. *President.*] I understand, Mr. Thow, that you want to correct an error in the evidence you gave yesterday with reference to the rail broken at the Tarana accident. I believe you had not your notes when you were here yesterday? No.

8003. You found, I understand, that the rail you said was broken and submitted to a test, and which was fractured by a fall of from 6 to 12 inches, was not the rail in question, but another taken from a scrap

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- Mr. W. Thow. scrap-heap. Will you explain what took place with regard to the Tarana rail and the tests you applied to it? We tested two pieces of that rail. There was only one drop test applied to the first piece, and it broke with a fall of 4 feet 2½ inches. It broke very freely.
- 27 May, 1892. 8004. *Professor Warren.*] That was the worse of the two, I take it? Yes; the first we tested. It had only one blow.
8005. It broke with a test then of 4·3 foot tons? Yes; that would be about it. We then tested the second piece of the same rail, and subjected it to four blows, 1, 2, 3, and 6 feet falls, and it broke very freely under the last blow (6 feet).
8006. That equals 12 foot tons? 6 foot tons, I think.
8007. Yes; 6 foot tons is the final blow? It broke very freely. That is all I have to correct.
8008. *The President.*] Mr. Hoyle wanted a copy of the Western load table? Yes; I hand that in.
8009. I understand, Mr. Thow, that yesterday you undertook to give Mr. Hoyle the height of the cab of the American passenger engine from the rail. I understand you to say in the paper before me that the height is 12 feet 2 inches at the sides, and 13 feet in the middle.
8010. *Mr. Hoyle.*] That is 12 feet 2 inches from the rail to the highest point? Yes.
8011. *Professor Warren.*] I see, Mr. Thow, that your name is attached to the report of tests I have before me. In it I see a statement that looks like a bending test, is that so? The first table in that statement relates to the hydraulic test, and the second is the falling-weight test.

8012. *Mr. Fehon.*] With regard to Messrs. Pollock and Kidd's original report of the trial of tests made at the desire of the Commission upon a recent occasion, I desire to state that Mr. Pollock is now present, and I wish to call him in order to answer any questions the Commission may desire to put to him.
8013. *Professor Warren.*] Unfortunately I have not had an opportunity of reading that report; perhaps you can call another witness first.
8014. *Mr. Hoyle.*] I wish to explain before that is done that a minute was asked for by me yesterday in connection with the cost-book which has been produced before this Commission. I notice on a page where the entry of the alteration I have referred to, made for the purpose of permitting the Baldwin engines to pass, that minute is given as D.E. 91-1048, but on getting that minute, at least one bearing that number, I find that it has got no reference whatever to this matter; therefore the minute that has been handed in to me is of no use.
8015. *President.*] What officer handed that in?
8016. *Mr. Brown.*] Do you want that paper, Mr. Hoyle?
8017. *Mr. Hoyle.*] I did want it, but I will not press for it now.
8018. *Mr. Fehon.*] You will have Mr. Halligan recalled, and you can question him about it.
8019. *Mr. Brown.*] Where was it obtained from?
8020. *Mr. Fehon.*] Bathurst.
8021. *Mr. Hoyle.*] It should be Newcastle. I think I can explain how the mistake arose. I asked for a copy of the report sent to the Engineer for Existing Lines made by Mr. Watson with reference to the effect of the Baldwin engines upon the road. Mr. Watson is the divisional engineer at Bathurst. Probably this number has been sent to him by mistake. The telegram for the minute I asked for should have been sent to Newcastle.
8022. *Mr. Fehon.*] Mr. Halligan will be called presently, and perhaps he will be able to give you some information upon the point.

Edwin Molloy Halligan recalled :—

- Mr. E. M. Halligan. 27 May, 1892. 8023. *Mr. Hoyle.*] I wish to point out that certain questions were asked Mr. Halligan relative to alterations to platforms. The answers to those questions did not seem to me to correspond with the entries in the cost-book of alterations made in his district, and I wish to recall him in order that he may have an opportunity of correcting that evidence, or explaining the discrepancy between it and the entries in the cost-book. He may have given the statements contained in his evidence from memory, which was only partially correct, and I therefore thought it right that he should now have an opportunity of correcting those statements.
8024. *Mr. Brown.*] I understand that certain questions were asked by Mr. Hoyle, and Mr. Halligan, in the report of the evidence which was forwarded to him, desired to alter the word "here," contained in Mr. Hoyle's questions, to the words "to Newcastle."
8025. *President.*] Yes, you will find one place at least where he alters "here" to "Newcastle."
8026. *Mr. Hoyle.*] You were asked, Mr. Halligan, "Have any additions been made to the structure or permanent-way since the Baldwin engines came here?" to which you answered "None." Now, from a charge I see in the cost-book, I see that alterations have been made in the platforms since the engines came here.
8027. *Mr. Brown.*] Mr. Halligan, I understand, desired to amend that statement by striking out the word "here" and inserting "to Newcastle" in Mr. Hoyle's question, the effect of which would be to alter the whole tenor of the question. Now we find, since the book containing the entries of the alterations has been produced, that your evidence would correspond with those entries if the word "Newcastle" were substituted for "here" in Mr. Hoyle's question? (*Witness*): I did not know the word "here," and so I made the alteration.
8028. *Mr. Brown.*] It was very important to Mr. Hoyle's case if your answer were given as it stands to the question he put, so it was thought desirable to recall you, that you might have an opportunity of correcting or explaining this matter. You did make the correction, but it was in Mr. Hoyle's question, and being very material, the Secretary would not allow it, and so you have been recalled. The question put to you was, "Have any additions been made to the structure or permanent-way since the Baldwin engines came here?" to which you answered "No." Now, what have you to say about that? (*Witness*): I don't know when they came here; I have no idea when they arrived. I meant to say that after the first Baldwin engine came to Newcastle there were no alterations made.

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8029. *The President.*] But you said in your evidence "here"—meaning, I presume, "Sydney"?

8030. *Mr. Hoyle.*] I suppose you took "here" as meaning Newcastle?

8031. *Mr. Brown.*] You see, Mr. Halligan, that it is material to Mr. Hoyle's case to show that these alterations were made for the Baldwin engines; that is what he desired to get from you, and the alteration you have made has changed that altogether.

8032. *Mr. Hoyle.*] "You told us that nearly all the platforms had been altered in the North—why was that?" to which you answered, "In order to get uniformity of gauge, I understood. There was a Conference of Engineers in Mr. Goodchap's time in 1888, before the line was opened to Hawkesbury, before I took charge of the Northern district the platforms were all different gauges, and he wanted uniformity in them." He then asked you "When was this work absolutely commenced" and you answered "About twelve months afterwards, about June." He then said "Were these platforms altered prior to the importation of the Baldwin engines," and to this you answered "Yes." You were subsequently asked if on the trial trip you made you saw any of the engines touch anywhere, and you said "No," and that the cab of the engine did not touch anywhere but was very close at some places; it was close at Cockle Creek, and you also said that after this trial trip spouting was lifted about 3 inches at East Maitland and Cockle Creek. Mr. Halligan has stated that these alterations in the platforms were made to bring the lines to gauge, and I wish to know how he reconciles this with the statement contained in the cost-book.

8033. *Mr. Brown.*] The entry in the cost-book is "Altering platforms to give clearance to new locomotives"? That is a heading I would not take any notice of, the clerk who made the entry would put any heading to it which he thought would distinguish it. I think I can show you other entries in similar words in the books.

8034. *Mr. Hoyle.*] Yes, there are others.

8035. *Mr. Brown.*] Mr. Hoyle says that these alterations were made in consequence of the importation of these locomotives, and this entry is made in a book connected with your department. It appears to be against these new engines, it says "To give clearance to the new locomotives," and the sum debited is over £1,000. (Witness): It is just a question of how a clerk enters it up. [*Witness here pointed out another entry of a similar nature.*] This alteration was made in order to bring the line up to gauge, and yet it is entered for the clearance of engine 304.

8036. *President.*] So that in both cases you have put it to the engine instead of the gauge? Yes; it is a matter of entering up.

8037. *Mr. Brown.*] Do you not see the importance of your evidence in connection with the charge made against the engine. Is there no other explanation you can give, except that with regard to the clerk? We had the same charge previously, and it was all for the same thing, widening the gauge. I do not enter up the charges myself, there is a number to each of them.

8038. *Mr. Hoyle.*] 229 A. is the number of the order attached to this charge.

8039. *Mr. Brown.*] Do you remember the contents of that order from memory? (Witness): No, I do not.

8040. Could you find it out? I daresay I could.

8041. *Mr. Brown.*] Would that order correspond with this heading? It might or it might not. The heading might be in the words of the order or it might not.

8042. Would not the clerk follow the words of the order? As a rule I think he would follow pretty near the words of the order.

8043. *Mr. Fehon.*] As a matter of fact the alteration of the platforms was proposed some years before the Baldwin engines were thought of; is not that so? Yes, on the north.

8044. And when the Baldwin engines were ordered it was known that a great number of the platforms were not to gauge, and instructions were given to bring them to gauge? Yes, as quickly as possible.

8045. And you hurried it on? Yes, it was rushed towards the end.

8046. *Mr. Brown.*] I thought the case for the Commissioners was, that the importation of these engines had nothing to do with the platform.

8047. *President.*] Neither has it. They say "We were going to alter these platforms to a uniform gauge, orders had been given to bring them to that uniform gauge years before these engines arrived," and the Commissioners say that they were only carrying out those orders, but that when the Baldwin engines had been determined on, anticipating that they would be of a large size, they hurried on the work.

8048. *Mr. Brown.*] So it is a coincidence?

8049. *Mr. Fehon.*] Yes.

8050. *Mr. Hoyle.*] You say in your evidence that these platforms were altered prior to the importation of the Baldwin engines, I find that the date of the completion of the platforms was the 14th September, 1891, It does not say in your evidence that the platforms were in course of alteration, but that they were altered? I certainly stated that, for I knew the platforms were altered before I went on the trial trip. I am certain they were. I am speaking of when I took the trial trip to the Queensland border and back, at that time the platforms were all altered.

8051. *Professor Warren.*] They were finished before you started? Yes, if they had not been I should not have attempted to start.

8052. *Mr. Hoyle.*] I may state that probably this matter of the Baldwin engines may not end here, and there might be attempts made in the future if this matter cropped up to question what has been said, and if I should have to review this case hereafter, and perhaps have to go to my constituents upon it, I would not care to say that Mr. Halligan's book stated one thing and the evidence another, therefore I have recalled witness, in order to giving him an opportunity of reconciling his evidence. (Witness): Quite so.

8053. *Mr. Hoyle.*] I did not wish to take advantage of you, in any way. (Witness): Could I ask Mr. Hoyle if he would instead of giving the date of importation give me an exact date?

8054. *Mr. Brown.*] The engines came here in June or July, 1891.

8055. *Mr. Fehon.*] The first engines were in steam in July, 1891; but they were not running on the road regularly, they were doing their 1,000 miles preliminary running, which it was necessary for them to do before being passed and considered fit to run on the main line in regular work. I do not think any of them were running regularly in July. It was well into August before any of them ran on the main line.

8056. *Mr. Brown.*] You see that these engines were not in steam until July, 1891, and the cost-book shows that on the 14th September of the same year certain alterations were made in connection with the platform, under the head of "Giving clearance to the new locomotives."

Mr. E. M. Halligan.
27 May, 1892.

8057. *Mr. Hoyle.*] This passage is contained in your evidence :—
Mr. Brown.] Were any alterations made prior to the engines arriving? Yes.
How long before? They were altered six months before, and some up to date of arrival in Newcastle.
Were many of them altered? A great number of the platforms.
Nearly all of them? Yes, nearly all on the old line.
When were these alterations begun? About 14 months ago.
January, 1891? Yes; I think that is the date; about 14 months ago.

8058. *Mr. Brown.*] Then he must be wrong in that.
8059. *Mr. Hoyle.*] Now the book shows that alterations were made to the platforms on the 14th September of last year.
8060. *Mr. Brown.*] And the engines were imported in June last, 1891? That is the importation into Sydney, sir, not Newcastle.
8061. *Mr. Brown.*] The date of importation is not the place, but the time when they arrived here? I was not aware of that.
8062. *President.*] Why could you not have said in your answer when your evidence was sent to you :—
“I do not know the date of the importation of the engines into the Colony, but I can say that all of the alterations in my district were made before a certain date,” that would fix it.
8063. *Mr. Hoyle.*] All the alterations were made before the engines went to Newcastle, you say? Yes.
8064. The platforms were all altered before the engines came to you? Yes, in my division.
8065. And you believe that the heading contained in the cost-book is a mistake so far as the clerks are concerned? I do not blame anybody for that. It might have been entered up in a clerical way. It might be right so far as I know.
8066. *Mr. Brown.*] You say the heading would probably follow the words of the order 229 A. I might add this point—that the evidence you tender, or that tendered by anyone else in your position, ought to be as reliable as you can make it.

Robert Pollock, being sworn, said :—

Mr. R. Pollock.
27 May, 1892.

8067. I am a consulting engineer, practicing upon my own account. I am President of the Engineering Association of New South Wales.
8068. *Mr. Fehon.*] Have you had considerable experience in determining the power of various engines at various times? Yes.
8069. Did you conduct certain trials on Sunday, May 15? Yes.
8070. You were associated with Mr. Kidd in making those trials? Yes.
8071. And you and Mr. Kidd reported upon them? We did. [*Report produced.*]
8072. Did you consider the result of those trials satisfactory? Yes, I did.
8073. I have no further questions to ask you.
8074. *Professor Warren.*] Did you work out the horse-power required in drawing a load of 176 tons on the 1 in 40 grade at 22 miles an hour? No; I think you will see that the tractive power is given in the report.
8075. You have not compared it with any fixed standard of requirements which have been submitted to you? No; only the weights the engine was supposed to pull.
8076. Did not the Commissioners send you a letter saying that the engine was expected to pull a load of 176 tons up a grade of 1 in 40 at a speed of 22 miles an hour? Yes.
8077. Did you work out the horse-power necessary to do that? No; I only worked out the horse-power the engine developed at different times on the trial trips.
8078. I am sorry you did not do that, for then you could have compared the horse-power you actually obtained with the horse-power which the engine was expected to develop? I worked out the horse-power of the work accomplished in the day.
8079. I refer to the horse-power that would be shown by drawing a load of 152 tons up a grade of 1 in 40 at a speed of 22 miles per hour? I do not remember the tenor of that letter.
8080. None of your speeds reached 22 miles per hour, though your loads sometimes exceed the standard of 152 tons, what was the highest speed you obtained? The highest speed we obtained was on the fifth trial, it is given in the report.
8081. Did you compare the speeds I sent you with your own? Yes, and with your times also. They all come out very closely to within an eighth I believe. In the main they were very good.
8082. The load was 5 tons 2 cwt. and 11 qrs., and more than was intended I think? Yes.
8083. You agree that it is right to take the indicated horse-power after the engine had settled down to its work? Yes. You will notice that on the fourth trip she was gaining speed, and gaining steam up the 1 in 30.

No of indicator card.	Mile-post where taken.	Speed in miles per hour.	Boiler pressure.	Initial pressure.	M.E.P.	I.H.P.	Tractive power.	Resistance in lbs. per ton of whole train.
			lbs.				lbs.	
19	66½	20·45	155	142	97·85	912·0	16,732	4·12
20	67	17·64	155	144	107·5	864·7	18,382	11·8
21	67¾	17·45	160	144	106·6	849·8	18,228	11·17
22	67½	16·82	155	145	109·7	841·8	18,758	13·6
23	68½	17·47	155	142	108·4	863·5	18,536	12·6
24	68¾	18·19	150	136	103·8	830	17,749	8·9

8084. In recording the horse-power of these engines, would you take the last four results in this report as your basis? There is a diagram accompanying this report showing the grades and the time in which they were taken, and a tracing that will show you when the engine was fairly on the grade, there are a good many curves on the gradients, and they, of course, would affect the speed. I think the gradient, in order to try the engine fairly, ought to be straight. In the diagram, I have referred to, you will see exactly where the curves are, and where the engine settled down to her work.

8085. It would be unfair to average all the horse-powers, and take that as the horse-power of the engine, would it not? Yes. I should take out the first trip, I think.

8086. *Mr. Fehon.*] The horse-power will fall going up the grade.

8087. *Professor Warren.*] No; because if you were drawing nothing you would get no pressure on your cards, but these have all been taken from indicated diagrams, and they would correspond with what you would get drawing a weight up a certain height? There is a beautiful correspondence between these horse-powers, and what we expected.

8088. How did you get the resistance? We first took the whole weight of the train and engine, and then divided it by the grade.

8089. This is the resistance in lbs. per ton in the report? Yes; on the level.

8090. That varies considerably? I put it down considerably; the curves affected it to some extent.

8091. Take trial No. 1, you say the speeds there were 17, 17, and 15; the engine was evidently feeling the effect of the grade? You must compare that with the falling steam power.

8092. Then take the other, 18, 18, and then it increases a little;—that would be a fair average to take? I think you might leave out the first two, but that is a good deal a matter of opinion.

8093. You would consider that a fair thing? Yes.

8094. I think it would rather overstate the horse-power, but you would think it fair? Yes.

8095. If I average it at 64 or 65, I would take a fair average? Yes; I think you would.

8096. The best test of all is No. 5;—that is undoubtedly better than any of the others; the speed is higher and the road heavier—5 tons 12 cwt. and 2 qrs. heavier, more than was ever expected, and the speed is practically 20 miles an hour? Our speeds were sometimes a little over or a little under yours, but on the whole we thought that they were remarkably alike.

8097. There is one diagram that Mr. Pollock has referred to, which shows the grade and the position on the grade at which the indicator diagram is taken;—could you let me have that tracing, Mr. Fehon?

8098. *Mr. Fehon.*] Yes.

8099. *Professor Warren.*] I shall send it back to you; I merely want it in order to check for the purpose of verification.

8100. Did you use a planimeter? Yes; and then we checked off.

Howell Bland, being sworn, said:—

8101. I am assistant running foreman at Eveleigh; previous to that I was travelling locomotive inspector on the Southern and Suburban line. I have been in the service of the New South Wales Railway Department between twenty-three and twenty-four years; for about fourteen years I was a driver.

8102. *Mr. Fehon.*] You have had a large experience of engines, and have ridden on the footplates of all the different types? Yes.

8103. You have ridden on the Baldwin passenger and goods engines? I have.

8104. Will you tell the Commission briefly your experience of these engines? I found that both the passenger and goods engine did all that was required of them. Their performances were beyond my expectation. I always found them to run freely and well, and to take the curves better than most of our English engines. I have ridden on the passenger engine at the rate of 50 miles an hour, and I have no hesitation in saying that they rode comfortably and safely, and did not injure the road in any way so far as I could see.

8105. Did you consider that they rolled more than other engines do? No, I did not, although the impression might be given that they did on account of the driver standing so high. The driver stands much higher on the Baldwin engine than he does on the ordinary English engine, so that these engines would appear to roll much more than they would if the driver stood lower down.

8106. You consider them to be comparatively easier than any other class of engines on our lines? Yes, I fancy that they ride easier.

8107. Do not they draw alone the loads which previously required two engines to draw them? They do.

8108. What is your opinion as to whether one large Baldwin engine or two smaller engines coupled together are easier on the road? Certainly I think the one Baldwin engine is easier than the two engines coupled together.

8109. Are they not easier in every way, being controlled by one set of men instead of by two? It must necessarily follow that a train is more easily managed and better in other ways in the hands of one man—that is, under his control—than under that of two. It is difficult to get two men to work in unison with each other.

8110. With your experience of the lines and roads of the New South Wales Railway, do you consider them to be suitable to the Baldwin engines? Yes; I do.

8111. Do you think them a valuable addition to the rolling stock of the New South Wales Railways? Yes; I think they are a valuable addition, so valuable that we have been able to reduce the number of drivers considerably, on account of these engines doing the work which previously two engines had to do, necessitating the employment of two sets of men where now only one set is required.

8112. *Mr. Hoyle.*] You say that these engines did more than you expected of them;—what would you expect? I expected them to haul about 200 up the 1 in 30 grade. I am speaking now of the consolidation goods engine. The passenger engine I expected to draw 125 to 130 tons up the same grade, and they are doing more than that now.

8113. Upon what do you base your opinion;—were you consulted when the engines were ordered? No.

8114. Did you know anything about them before they came here? No.

8115. So you had no way of forming an opinion about them till they actually came here? No, only that from my practical experience I came to the conclusion in my own mind as to what they would do.

*Mr.
R. Pollock.*
27 May, 1892.

Mr. H. Bland.
27 May, 1892.

- Mr. H. Bland. 8116. What was there about the engine that led you to come to that conclusion? There was nothing in particular except that, from the way the old Baldwin's handled the light trains, I came to the conclusion that the new engines would handle a heavier train in a certain way.
- 27 May, 1892. 8117. But you must have had something to go upon that made you arrive at this conclusion; what made you think that they would haul these loads of 200 tons in the case of the consolidation engine, and 125 to 130 tons in that of the passenger engine; what was it led you to believe that these engines would do that—I mean from an engineering point of view;—how did you arrive at these conclusions? I was led to believe that the engines were brought here to run the through Southern express to Juneau, and they were put on that road and did run the express, and I have no hesitation in saying that if the material in the bogie axles had been what it ought to have been they would have been running that service now.
8118. You say you believe that these engines were brought here to run the express? Well, I did not know.
8119. You were told? Yes; it was the general opinion.
8120. Well, now that these axles are put right, and since the engines haul so much more than others, why are they not used for the express service? We have other engines on the line now doing the work just as well.
8121. You said that two engines coupled together would do more harm to the road than one heavy engine? I said that is my opinion.
8122. But we want you to give more than an opinion; what you are giving here is evidence; if you say these engines are doing a certain thing, it comes before the Commission as a fact. Have you had anything to do with the permanent-way of the colony? No.
8123. Do you know anything about civil engineering? No.
8124. Then, do you think you are qualified to give, or capable of giving an opinion upon this matter? No.
8125. Then, any statement you make upon this question will be simply a matter of opinion of an unprofessional character? Yes, quite so.
8126. Now, about the loads these engines will haul, you say these passenger engines will haul 125 to 130 tons up the 1 in 30 grade at what speed? About 12 to 14 miles an hour.
8127. I presume that your experience only extends to the metropolitan district; have you control beyond Sydney? Yes.
8128. Does your duty take you to Newcastle? No.
8129. Or Penrith? No.
8130. The metropolitan district will extend, I suppose, up to Pictou? I have control to Albury.
8131. When these engines were running in Sydney did they give much trouble; were the breakages in connection with them any greater than those in connection with other classes of engine? Not more than with new engines usually. That is until the axles began to give way; that was the first serious trouble they gave.
8132. Would you be prepared to answer any questions relative to the axles, the bearing service, and that class of matter? No.
8133. You are not competent to do so? No.
8134. You belong to the driving section of the Department only? Yes.
8135. *Mr. Fehon.*] As far as you have had experience with these engines, have they had more breakages than ordinary new engines? No.
8136. Was it a new experience for reversing gear to give way, or a fulcrum pin to drop out? No; there is always something in new engines that requires to be done; when 304 class was brought here we had to make a great number of alterations.
8137. *Mr. Hoyle.*] Do you mean the 304 Dubs, or Baldwin engines? The 304 Baldwin; when that class first came here there was very considerable trouble in getting them to run at all, on account of the big ends-getting hot, on account of the faulty lubrication; it was some weeks before we could get them beyond Parramatta.
8138. *Mr. Fehon.*] Comparing new English engines with these new American engines, have the breakages and repairs in the latter been excessive? Yes; I rather think it has been more on these engines than on the English engines; yes, I think so.
8139. About the mechanical part of the Department you know nothing?
8140. *Mr. Hoyle.*] Have any of the drivers complained about these engines? So far as I know, the drivers have always spoken highly about the engines, and have wanted to get them again.
8141. Are you sure there have been no complaints of a general nature since they first commenced to run? Not that I know of.
8142. Have you heard that there were complaints about them? No, I never have.
8143. *Mr. Hoyle.*] That is all I wish to ask the witness.
8144. *Professor Warren.*] I would like to ask Mr. Pollock a question. There was a certain amount of coal and water consumed on our trial trips, and I find that that has not been deducted from the load, there were 3 tons of coal taken, I believe. Would Mr. Pollock give me the quantities consumed?
8145. *Mr. Fehon.*] I do not know anything about it. The driver running that trip would probably know.
8146. *Professor Warren.*] Did he take a note of the quantity of water and coal consumed?
8147. *Mr. Fehon.*] Yes, I think the driver would perhaps have the best knowledge of that.

John Chudleigh, being sworn, said:—

- Mr. 8148. I am the driver of the train which made the trials on Sunday, 15th May.
- J. Chudleigh. 8149. *Mr. Fehon.*] Do you know how much water was consumed on the total trip—how many gallons? No, I do not.
- 27 May, 1892. 8150. I have the coal, but I want to get the water.
8151. *Mr. Bland.*] I believe I could get you the water consumed, but not immediately.
8152. *Mr. Fehon.*] How many years have you been in the service of the Department of Railways? I have been eleven years in the service, and have been a driver for eight years. I have had experience on other lines—Joadja Creek and other places.
8153. You have driven a Baldwin engine have you not? Yes.
8154. Do you consider that they travel as easily, or more easily, than other classes of engines you have driven? I think they travel more easily than other classes.
- 8155.

8155. Do they take their curves more easily? Yes; very much.

8156. Do they not draw the loads alone which previously you had two engines to draw? Yes. I can only speak with regard to passenger trains, as they are all that I have had experience of. Mr.
J. Chudleigh,

8157. Can you give an opinion as to whether you consider one Baldwin engine or two ordinary engines coupled together to be easier on the road? I should say one Baldwin engine, certainly. 27 May, 1892.

8158. Do you not feel more confidence in keeping time and drawing your load with a Baldwin engine than with any other class of engine on the New South Wales Railways? Yes, so far as I have experience of them.

8159. You have had better time with the Baldwin engine than with any other class of engine? Yes; we have kept time easier.

8160. And I understand that you have never driven an engine in which have had greater confidence than in the Baldwin engine? I have never had more confidence with other engines than with the Baldwin.

8161. With your experience of these engines and of the roads of the New South Wales Railways, do you consider these engines to be well suited to the roads and the roads to be well suited to the engines? Speaking of that, I do not find any difference in the running between the Baldwin engines and the others—it does not seem to me to make any alteration in the road, that I know of.

8162. They run very smoothly, do they not? Yes; they run smoother than any other that I know of.

8163. And you consider that these engines are a valuable acquisition to the locomotive stock of the railways of New South Wales? Yes; I certainly do.

8164. *Mr. Hoyle.*] How long have you been driving these engines? Not regularly for any time to speak of—three months is the longest, regularly.

8165. Where? On the South Coast line and to Goulburn (and as far as Junee junction in the south).

8166. When you were running on the South Coast, you said that you did not find that the engine gave you any more trouble than other engines;—did you find about Stanwell Park that they were any worse? No worse.

8167. How many vehicles could the “Scotch Yankee” take? It could take fourteen up 1 in 30 grade.

8168. And the Baldwin could take eighteen? Yes.

8169. So that, as a matter of fact, the Baldwin could only haul four more vehicles than the “Scotch Yankee.” Is it within your knowledge that the “Scotch Yankee” has taken sixteen vehicles to Newcastle unassisted? I am speaking of the southern road.

8170. But the Newcastle is a harder road? I beg your pardon.

8171. *Professor Warren.*] You have 1 in 30 and 1 in 40 grades, have you not? The Southern is the heaviest.

8172. *Mr. Hoyle.*] Do you think the “Scotch Yankee” could take more than fourteen vehicles? No; I think it would take them all their time to haul the fourteen to time.

8173. You say you had more confidence in driving the Baldwin engine than in driving any other engines you know of; did you have more confidence in driving it than in driving the “Scotch Yankee”? I do not say that. I had as much confidence in the Baldwin as in the others.

8174. No more? I could not say more, but they rode easier.

8175. Is that because of the greater weight on the road or of the better compensation? Yes; I think it was the better compensation.

8176. It is only fair to explain that, because it has a great deal to do with the easy riding, but that does not presuppose that necessarily the engine is doing less injury to the road, does it? No.

8177. You said that one engine on the road was easier than two coupled together? Well, you find that out from practical experience. In curves, for example, the coupled engines strike very hard, but with the Baldwin engines that is not so.

8178. What speed do you run round a curve with a Baldwin engine? Up to 20 miles an hour.

8179. And at what speed with the other engines? Twenty-five miles an hour.

8180. And you say at 20 miles with a Baldwin,—that is less than with the others? We are not allowed to go at more than 20 miles an hour with the Baldwin engines round the curves.

8181. Why are you restricted to 20 miles an hour with the Baldwin engines round the curves? I do not know.

8182. Is it because of the extra weight striking the curve? I would be prepared to go at a higher rate with the Baldwin than with the others; I do not know why the order was given.

8183. Then there has been an order issued? Yes.

8184. Then as to the two engines coupled together, you know that the two do not strike together? No, but they make a longer wheel-base.

8185. Has that anything to do with the effect on the curve? The engines are binding more, the leading parts of the engine would bind more on the curve.

8186. Why? Because of the two engines being longer on the same circle.

8187. But does not the bogies give to the curve in going round it? On the first engine it might, but the other engine is tightly coupled to the first.

8188. So then it is the tight coupling? Yes; they must be coupled tightly together to prevent jerking.

8189. I may say that you have given me the most satisfactory explanation that I have had from any one as to this matter since we came here? But I am only telling the truth.

8190. How did you know? By the feel of the engine.

8191. You are not prepared, I suppose, to give an opinion outside of what you think? You can feel the engine over the road, and tell whether the engine rides smoothly or roughly over the road.

8192. Did you ever get stuck up in the Otford tunnel? No.

8193. Did you ever hear of others getting stuck up there? Yes.

8194. What caused that, was it slipping or a too heavy load? Either of those causes would do it.

8195. What loads do you haul on the South Coast with these engines? What I ran on the South Coast were trial trips, breaking the engines in, but I hauled double passenger loads on the South.

8196. What do you mean by that? That is double the ordinary passenger load—eighteen vehicles in all.

8197. Are there nine vehicles to each load? Yes.

8198. Do you know what was running on the express then? The Dubs engine.

8199. “Scotch Yankee”? No.

8200. The four-wheeled couple? Yes.

8201. Was the Dubs passenger engine the strongest you had then, or was there any more powerful engine in the service than it? Yes. 8202.

- Mr. J. Chudleigh.
27 May, 1892.
8202. But not running on the express? No.
8203. Have you a passenger engine in the service that can take a greater load than the Dubs express engine? The "Scotch Yankee."
8204. But they were never used on that run? No.
8205. The platforms had something to do with that, had they not? No; I ran them on the same road.
8206. Have you ever driven these engines at 50 miles an hour? Yes, before the order was given to reduce speed to 40 miles an hour.
8207. Why was that? I do not know, it is not because the engines are not doing the work.
8208. But there must be some reason for it? Yes.
8209. When you were driving these engines did you have any failures? I did not have a break down—but I had some little failures.
8210. Of what kind? Hot tender-boxes, but nothing to cause the engine to lose time.
8211. Did you have any failures of reversing-gear or brake-gear? I had one with the brake-gear—a bolt came out.
8212. Have you driven the engines since the new steel axles have been put in? I have.
8213. Have you found any trouble with them? No.
8214. They are not running hot are they? No.
8215. How about your tender-wheels generally, have you found them pretty good, and free from heat ing? Yes, even with the old axles, there was only one I had any trouble with.
8216. They are now all fitted with the new axles, are they not? I believe so.
8217. Will you tell me what coal you used for the trial trip? Nearly 5 tons.
8218. What kind of coal was it? Helensburgh.
8219. That is the best coal, is it not?
8220. *Mr. Brown.*] No; Newcastle coal is the best.
8221. *Mr. Hoyle.*] The Helensburgh coal is splendid steaming coal, that I know from my own experience. I heard that you used ordinary coal on the trip? It was the common coal we used. If you get the large Helensburgh coal it is very good, but the small is very bad.
8222. Did you use sand on the trial? Yes, we always do, on passenger trains especially.
8223. But on the trial did you use sand? Yes.
8224. Much? About 1 cwt.
8225. Did you apply it on the 1 in 30 grade? Yes, round curves.
8226. But on the grade? Not always—where the wheels were liable to slip.
8227. Are the Baldwin engines more liable to slip in ascending the grade than other engines? I do not think they are.
8228. Are they more liable to slip than the "Scotch Yankees"? I do not think so.
8229. I do not wish to ask the witness any further questions.

[*Mr. Fehon was about to call certain other witnesses.*]

8230. *Mr. Brown.*] Will the evidence of these witnesses be a repetition of what we have already had?
8231. *Mr. Fehon.*] Yes; it will be very similar, I believe. I have not asked them.
8232. *President.*] I presume they will come, and all say they are greatly satisfied with the Baldwin engines, and that they do their work well.
8233. *Mr. Brown.*] And probably Mr. Hoyle will make the same cross-examination—is it necessary to call these witnesses.
8234. *Mr. Fehon.*] Perhaps not. If the Commission is satisfied, I will not examine them.
8235. *President.*] Very well.
8236. *Mr. Hoyle.*] My cross-examination would be the same, but there is Driver Young, I would like to put him in the box for certain reasons.

W. W. Young recalled:—

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8237. *Mr. Hoyle.*] I want to ask you, Mr. Young, if you have ever driven an engine with a broken bar? I had not driven one at the time I was last before this Commission, but since then the engine I have been driving has a broken frame.
8238. You have an engine with a broken frame, you say,—what is the nature of the breakage? The breakage is in the main frame.
8239. Will you kindly point it out on the photograph in this room? Yes. [*Witness pointing out the breakage on the photograph.*] It is exactly between the leading wheel and the cylinder—it is a bar of the frame.
8240. Is it only cracked, or is it broken? It is broken.
8241. And what would have to be done in that case;—would not the engine have to be taken to pieces in order to put that right? The question as to how it would be done rests with the engineer more than with me.
8242. But the engine would not run again until it was made right? She is now running with a clip on the broken place.
8243. *Professor Warren.*] Do you know what the section is,—is it 3 x 2½? It is more than that,—I think it will run 4 x 4 or 5 x 5.
8244. *Mr. Hoyle.*] Were there any other engines with broken frames being driven before you gave your evidence last time? No.
- 8244½. Since then have you had any other mishap; since you have had this one, perhaps we may find out some others? The rocker arms are also showing signs of breaking—I refer to the top rocker arm. I would just like to say that I attribute that more to the system of lubrication than anything else, at all events, than to any defect in construction. I attribute the failure with regard to the rocking arm and the gear altogether more especially to the lubrication, the lubrication for the purposes of the pistons, the brake, and reversing-gear, communications of the valve does not seem to be sufficient to reduce the friction.
8245. *President.*] You do not like the system of lubrication? I do not think the lubrication sufficient to reduce the friction.
8246. *Mr. Hoyle.*] But with proper attention could there not be a sufficient supply of lubrication? It is the quality rather than the quantity; the quality is very bad, and the quantity is not sufficient.
8247. *Mr. Brown.*] What you say is the case with all engineers, they have not found out a really good stuff to lubricate with.

8248. *Mr. Hoyle.*] Do you think the provision for lubrication is sufficient if you had the lubricant? It is a case of getting lubrication which will reduce friction under a high temperature; it is not a question of keeping cool, but of reducing friction under a high temperature.
8249. *Mr. Brown.*] There must be thousands of specifics in the way of lubricants? Too many.
8250. *Mr. Hoyle.*] Can you account in any way for the rocker-arm breaking;—if there was any undue strain on the frame let us know, or anything which happened to the engine in whatever way that would cause an undue strain—was there anything of this kind, such as a defect in the road or anything of that kind which might bring this about? Not to my knowledge; but there are two keys in the framing which are put there with the purpose of bringing it up to its highest pitch. I noticed that these keys began to shift, and I drew attention to them and they were driven up. After I had been down here at Sydney I went back to my post, and found that one of these keys had been lost altogether, and that of the other there was only about half an inch in place. I believe this gave the bottom bar an undue strain, and therefore it has broken. There is no reason why the keys should shift if strongly fitted at first. I believe that is the reason why the bottom bars broke, namely, from the severe strain it got in consequence of these keys shifting.
8251. Would there be an undue strain in consequence of an exceptionally heavy load? You have a given pressure of 161, but if you were to put on twice the load you could not put on a greater strain; that is to say, you could not increase the strain by increasing the load, but you might get a strain through slipping. When the engine is slipping, say in going round curves, and with sand on both rails, then it would be hard for anyone to determine exactly what strain comes on the whole frame or any part of the engine.
8252. Do you find that these engines slip much? Yes.
8253. More than other classes of engines that you have driven? Yes, I believe they do.
8254. When you have exerted the whole power of your cylinder, have you found any slip then? Yes.
8255. Does that give you much trouble? It does that.
8256. How do you account for that—is it want of tractive power in the weight being too great for the wheels, or what is it? I am of opinion that in consequence of the pressure on the load the engine is loaded beyond her power of cohesion, considering the state of the rails and the wheels. The engines are not cleaned, the oil comes from the bosses and runs down and gets on the wheels, and the grip of the wheel on the rail is consequently affected.
8257. What is the average mileage when these engines run for 24 hours? Well; we don't run regularly for 24 hours.
8258. How many miles do they do in a week then. What is your distance? I run from Bathurst to Wellington, but the engine runs to Dubbo, and sometimes beyond that, so that I could not determine what mileage she does in a week.
8259. So that you cannot give us the mileage per week? No; I cannot. If I were running the engine myself I could.
8260. Have you had any failures of the reversing-gear or brake-gear? There have been little breakages which have taken place, but so far they have not stopped the engine, so that I would not call them failures. I have had a lot of trouble with the tubes leaking, but I have not actually had a break-down or anything of that kind.
8261. *Mr. Hoyle.*] I have no other questions to ask this witness.
8262. *Professor Warren.*] You say that these engines slip more than other engines? Yes.
8263. That looks as if there were not sufficient weight on the driving wheel? Yes; either that or the pressure is too high for the power of cohesion. You could lighten the load and then she would not slip, or you might reduce the pressure and then she would not slip, you could take it either way.
8264. Does the engine slip on a good dry rail? Yes; she would slip on a dry rail.
8265. That is, supposing that she had a maximum load? Yes; that is why I think she is loaded beyond her power of cohesion, because no engine ought to slip on a dry rail if she is properly proportioned.
8266. *Mr. Brown.*] Do you mean that she slips during her progress or at the start? During progress.
8267. *Professor Warren.*] Slipping at the start is nothing.
8268. *Mr. Hoyle.*] Did you find her slip much at taking the grade? She is worse on the grade, and better on the straight. That, as I have explained already, is caused to a certain extent by the oiling of the wheels; if she were clean and kept free from oil where the wheel comes in contact with the rail, it would be better; a greasy wheel will not have the same cohesion as a dry wheel.
8269. *Mr. Fehon.*] Are you speaking of the passenger or Consolidation engine? The Consolidation goods engine.
8270. You say that they are not faulty in construction, but the question is one of lubrication, or rather want of lubrication. It is this that causes the rocking-gear and reversing-gear to get out of order? Yes, although the reversing-gear, which is fixed up with pinions, does not look like a thorough mechanical invention; but as for the rocking-arm, eccentric rods, and so on, I do not see why they should not perform the work required of them if properly lubricated. The reason why I come to that conclusion is this: I have fired on the old Consolidation American engines, and I have never seen anything wrong with their rocker-arms or reversing-gear; but they were lubricated with tallow, and I do not think there has been any lubricant yet invented that can reduce friction under a high temperature better than tallow.
8271. And the breaking of the frame you attribute to the keys dropping out? That I think is the primary cause.
8272. And that would happen to any engine? Yes, if anything of that kind were allowed to go astray, it might appear to be simple at first, but there is no knowing what the result might be eventually.
8273. Where are the keys in the frame? They seem to join the front and the back part of the frame together; the two ends come together and are secured by bolts and keys; the bolts did not drop out but the keys did work out.
8274. *Mr. Hoyle.*] Would that be caused by improper fitting in the first instance? Yes, there is no doubt about that.
8275. Is it defective workmanship? Yes, it is defective workmanship, and has been the cause of the keys working out.
8276. Did you find that the old Consolidation American engine had as many failures as the Baldwin engine? Not with regard to slipping, and I never knew any of their reversing-gear to be; there have been failures with those engines, but not of the same description as these.

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8277. Taking the failures of the old Consolidation engines, would they be of the same or of more importance than those in the Baldwin Engine? Well, you must take into consideration the greater time the former had been running; the principal failures of the old Consolidation engine were blowing the cylinder ends out, and with regard to crank pins, and I do not doubt that these faults will also show in the Baldwin engines with the high pressure they have and the amount of slipping they do.

8278. *Professor Warren.*] The slipping shows the high power of the cylinder, does it not? Yes, or that there is something preventing cohesion.

8279. Would the reduction of the pressure obviate this? It might obviate the slipping.

8280. And the blowing out of the cylinders and the breaking of the crank-pins?

8281. *Mr. Fehon.*] But that does not happen in these engines? No, it does not take place in the Baldwin engines, I was referring to the old Consolidation. If you reduced the pressure you would reduce the speed.

8282. *Professor Warren.*] And therefore the utility of the engine.

Henry Robinson recalled:—

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8283. *Mr. Brown.*] Have you ever seen this paper? [*Paper produced being a report on No. 455 American engine working special between Emu Plains and Dubbo, to ascertain the clearance for cylinders and cab of engine between all platforms, verandahs, bridges, and tunnels, &c.*] *Witness:* Yes, it seems somewhat similar to a report I made, with reference to the clearance for cylinders and cab of engine between platforms, &c.

8284. *Mr. Brown.*] Will you turn to page 2, what does this portion of the report refer to? That was in connection with measurements made of the coal-stage at Bathurst.

8285. Has it anything to do with the coal-stages Mr. Hoyle asked you about? None whatever.

8286. Has it anything to do with the question contained in your evidence:—

Mr. Hoyle (to witness).] Did you make any reports in connection with the coal-stages? I made no report whatever.

Witness: That was in connection with the Eveleigh coal-stage.

8287. *Mr. Brown.*] Is that so, Mr. Hoyle?

8288. *Mr. Hoyle.*] I did ask some questions about the Eveleigh coal-stage, but then I asked elsewhere the general question you have quoted.

8289. *Mr. Brown.*] This is the general question you refer to? (*Witness:*) I answered that thinking you were referring to the Eveleigh coal-stage.

8290. *Mr. Hoyle.*] But then I asked you the general question before that.

8291. *Mr. Brown.*] You were asked this question, and gave the reply I have read. You must remember that you come here to give correct evidence, and not to mislead the Commission. Now here is the tenor of your evidence, and it goes to show, just as Mr. Hoyle says, that you are asked generally with regard to the coal-stages. This is your evidence on the general question, "Did you make any reports in connection with the coal-stages?" to which you answered, "Made no report whatever." Your evidence then goes on as follows:—

Was there not any investigation made relative to the coal-stages in connection with these engines? Not that I am aware of.

Were any alterations made at any of these stages to meet the convenience of these engines? I cannot say whether there was any alteration made or not, but I daresay the line was altered a few inches perhaps.

Had that anything to do with the width of the cylinders of the Baldwin engines? I do not know why it was altered at all.

Do you know if the coal-stage at Eveleigh was altered in connection with these engines or not? I do not.

This is a general report upon the whole question [*referring to paper produced*]. It is signed by you, and it refers, among other matters, to the coal-stage at Bathurst fouling the cab of the engine. Yet, when Mr. Hoyle asked you if you made any report in connection with the coal-stages, you said you had made no report whatever? (*Witness:*) At the time I was giving my evidence I was referring particularly to the Eveleigh coal-stage.

8292. How can you say that, when you were asked generally about the coal-stages? I was asked about the clearance of the engines on the Northern line.

8293. You had been as far as Wallerawang on the Northern, and Bourke on the Western line, and Mr. Hoyle asked you certain questions incidental to those trips;—it is not as if you were on one particular part of the line, but you went as far as Wallerawang? Yes.

8294. And you went to Bourke? No; I went to Dubbo.

8295. At all events you took two trips, one on the north and one on the west? Yes.

8296. You have been recalled with regard to that particular part of the evidence to which I have referred, and the Commission wish to know now if you desire to amend that part of your evidence, because they are under the impression that your remarks applied to the coal-stages generally.

8297. *President.*] Do you want to say that when you were asked if any alterations were made to the coal stages, and you replied "No," you meant that none had been made at Eveleigh coal-stage? Yes.

8298. *Mr. Brown.*] Our object in recalling you is that you may correct your evidence now. Is there anything more you have to say about Eveleigh. It seemed to me to be a very light and airy way of giving evidence, considering the difficulties the Commission labour under. Your explanation is that you intended to refer to Eveleigh coal-stage alone; but there is no reference to Eveleigh coal-stage whatever in the previous part of your evidence. You gave evidence that you had been as far as the Queensland border, and after that you were asked this question in connection with coal-stages generally.

8299. *Mr. Hoyle.*] I suppose you really had in your mind at the time the Eveleigh coal-stage only, and you meant to refer to that alone? At the time of my examination I was referring to the northern line and Eveleigh.

8300. I wish you would correct your evidence in that respect. There is another little matter that also requires clearing up. I asked a question with reference to Picton; the evidence was as follows:—

Did you go to Picton on the Southern Line with an engine? Yes.

Could you come past Picton platform before the rails snifted, I mean the line was altered? No.

You could not? No.

8301.

You could not pass Picton platform with the Baldwin engine until the rails were lifted or the station altered? Oh, we got past the station certainly, but the lines were afterwards altered I believe.

But the cylinder touched? No, it went very close.

8301. *President.*] Now, here is your report, which has been produced to you, and on page 3 you will find the following:—"Picton, cylinder fouled platform on down run," and here is your examination before this Commission on the other hand, in the words just read to you—how do you reconcile those two statements? (Witness): Well, certainly, the cylinder did go very close; it was the buffer that touched the platform.

8302. *Mr. Hoyle.*] But your report says: "Cylinder fouled platform on down run"; and in answer to Mr. Hoyle's question, "Did the cylinder touch?" you said, "No, but it went very close." Then he asked, "Could the engine have passed with safety running at the rate of say 30 miles an hour?" To which you replied, "I daresay, if all the brasses were in good condition. In that event we might have got through safely." I do not quite understand what is meant by the brasses.

8303. *Witness.*] In all the measurements, if there was not sufficient clearance, I made use of the word "foul." I have given no measurements in the case of Picton.

8304. *Mr. Brown.*] You have stated what was incorrect, as a matter of fact.

8305. *President.*] I understand this to be the fact, that the cylinder fouled. I could understand you making a mistake with your measurements, but whether the cylinder fouled or not is a fact which there was no getting beyond.

8306. *President.*] It is for your own sake that we have called attention to this.

8307. *Mr. Brown.*] Have you had an opportunity of perusing the evidence? I have had an opportunity.

8308. *President.*] Have you got a copy of your own report? I think I have; I think I can find it.

8309. It would be well to find it and amend your evidence, for the two statements are inconsistent. How do you explain this inconsistency? (Witness): We went up to measure the clearance between the platforms and the cylinder, and I made use of the word "cylinder" all along, because the buffer being of the same size it was just the same as if the cylinder had fouled. Coming into Picton we were on a curve, and naturally the platform would be very close to the buffer. The buffer-beam would strike.

8310. *Professor Warren.*] But in your evidence, in answer to Mr. Hoyle, you said nothing about that.

8311. *President.*] How could the engine get by if the buffer-beam struck? It might have scraped a little.

8312. Would it not be rather risky if you were going at any pace? Well, it would not be a safe thing to do in usual every day practice.

8313. But I see in your evidence that Mr. Brown asked you, "Would you like to be on an engine, going at the rate of 30 miles an hour, and have it pass so close to the platform as this passed;—would you have liked to have driven an engine through at that rate?"—to which you answered, "Yes, I daresay I could have driven the engine." Again he asked you, "Do you think it would have derailed the engine?"—and to this you said, "No; perhaps it might have scraped the buffer-beam, that is all."

8314. *Professor Warren.*] I should say, remembering the oscillation, that it would have knocked the buffer-beam all to pieces? (Witness): No; it just scraped.

8315. Do you mean to say that if you were going at the rate of 30 miles an hour, and the buffer-beam touched the platform, it would not be knocked to pieces; it is obvious from your report that it fouled? Well, I have been asked my opinion, and that is all I can say.

8316. *President.*] Do you say that you could drive an engine through the station with the buffer-beams scraping the platform whilst travelling at a speed of 30 miles an hour;—would you not have smashed something up? Mr. Brown, when he asked you the question I have quoted, meant, of course, did you get through clear? We could have passed that platform without carrying anything away.

8317. *Mr. Brown.*] Do you desire to amend your evidence? You had better take a copy of it with you, and, after comparing it with your report, consider what you really intend to say, and amend it accordingly.

8318. *Mr. Fehon.*] I may as well explain to the Commission that it is a very common thing, if a cylinder runs close to a platform, to say that it fouls.

8319. *President.*] Showing that the platform needs some alteration.

D. H. Neale recalled:—

8320. *Mr. Fehon.*] You are a member of the Institute of Mechanical Engineers? No; I belong to the Institution of Civil Engineers.

8321. How many years have you been a member? I have been an Associate Member 19½ years nearly, and I was a student before that.

8322. And do you hold any other diploma? I am an Associate of the Master Car Builders' Association of America, which embraces the principal locomotive and rolling-stock men of that country.

8323. What has been your experience in railway management? I have had altogether twenty-five years' experience. I served my pupilage on the North London Railway, after having served a pupilage with a civil engineer. I was on the North British Railway as general assistant to the Locomotive Superintendent. I was chief draftsman on the Monmouthshire and also on the Great Eastern Railway, holding the former position for twenty months and the latter for four years. I was assistant locomotive superintendent, and for a short time acting locomotive superintendent of the Cape Government Railways. I was inspector at home for the South Indian Railway, and I was also independent engineer for the Metropolitan District Railway, for which I designed standard rolling stock, and I have been connected more or less with other railways.

8324. Were you an editor of the *Railroad Gazette* in America? Yes; I was mechanical editor for that paper for five years, and in that capacity I wrote the articles about locomotives and rolling stock, and also many about permanent-way.

8325. Is not the *Railroad Gazette* considered amongst professional men a paper of very high standing as an engineering journal, particularly on questions of the management of railways? Yes; it is the leading paper for railway officers not only in the United States, but also, I may say, throughout the world.

8326. Had you, in the capacity as editor of the *Railroad Gazette*, an opportunity of becoming acquainted with the condition, from a civil and mechanical point of view, of all the principal railways of the

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the United States? Yes, I had; I met the leading railroad men in the United States, and they were all very kind in giving me facilities to inspect their latest improvements and information on subjects of interest to railroad men. And they depended upon me to disseminate that information.

8327. Can you give the Commission some idea of the weight of the rails used in the United States? It varies very much indeed. The rails in use most generally vary from 56 to 67 lb. per yard in weight. Of course there are some lines that have heavier rails, and during the last few years very much heavier rails have been introduced. I saw the first 80-lb. rail that was used in America. It was used on the New York Central Railroad, and it gave satisfaction, and they have since laid the line from New York to Buffalo.

8328. *President.*] I should like to ask here, Mr. Neale, whether they gave such satisfaction by reason of their durability or by reason of additional safety insured by heavy rails over light rails? They gave satisfaction because of their durability and the fact that they gave less trouble with the fastenings, which are the weak point in American roads, owing to the soft character of the sleepers.

8329. *Mr. Fehon.*] Are not the sleepers very soft in America as compared with the hardwood sleepers in use here? Yes; it is entirely due to the fact that there was no timber used in the United States, that could be used for sleepers, that is as hard and durable as ironbark. White oak is the best and most durable wood in America for sleepers on the roads, and that is far softer and lighter and much more liable to decay than ironbark.

8330. *President.*] What do they use for sleepers on the English railroads? They use Baltic pine generally—yellow pine creosoted, oak would be too expensive.

8331. *Professor Warren.*] They use larch too do they not? Yes, but it is an inferior timber, and for that reason is not used on main lines.

8332. *Mr. Fehon.*] And is not the ballasting very much disregarded on a great portion of the United States? Yes; taking the American railroads as a whole there is very little ballasting indeed. Of course on some roads, particularly between New York and Philadelphia, for example, they have stone ballast something like ours, but taking the majority of the American roads, and amongst them the Baltimore and Ohio over which the Baldwin engines are running, the lines are very poorly ballasted indeed.

8333. *President.*] Why do they not pay more attention to the ballasting of their roads? It is a question of economy. The American road is built cheaply and improved out of the earnings.

8334. *Mr. Fehon.*] Are you acquainted with the new and improved class of engines that they are now using in America? Yes, I am; they use the Consolidation engines which were first introduced about twenty years ago. They have greatly increased them in size and power, and have found great advantage in doing so, and more recently they have superseded the old four-wheel couple engines which were used for passenger trains, and put six-wheel coupled engines on the road instead. I witnessed the beginning of that movement, and talked to the people who had charge of the new type of engines, and they expressed themselves as very much pleased and delighted with their superior performances. Since then I may say that the movement has very much extended on a large number of roads, and now the ten-wheeled and Mogul engines are used to a large extent. The preference is for the ten-wheelers although it is a little heavier. They prefer it because they think the ten wheels give a little more security.

8335. *Professor Warren.*] What is the maximum weight of consolidation engines in America? They run up to very heavy weights, the heaviest is about 66 or 67 tons without the tender.

8336. *Mr. Fehon.*] Give us the weight of the engine and tender combined, because that is the way in which it has been calculated in this Commission? Engine and tender combined in some instances is up to 100 English tons.

8337. *Professor Warren.*] The Decapod engine would be over 100 tons would it not? Well, it might, or it might not, they might use ten wheels instead of eight so as to better distribute the weight over more wheels. The Decapod engines are not, however, in general use in the main lines in America, they are only in use on the special inclines.

8338. And are not the Consolidation engines generally used in America with safety, and running with good results? Yes; the managers and engineers, to whom I have talked on the question, amongst them Mr. Ely, the leading Superintendent of Motive Power in the United States, with whom I had a long chat on the subject of the lower freight rates as compared with those in England, notwithstanding the difference in wages, said that he believed that the most important reason for the lowness of rates in America was the use of powerful locomotives. The average rate per ton per mile is a halfpenny on the American railways, and it is continually being reduced, whilst in Great Britain, although the rate is not actually known, I may safely say that it is fully a penny per ton per mile. I have just been working out the pecuniary result of these different rates, and I find from "Poor's Manual" that the difference in rates on the annual business of the American railroads as against the English rates is equal to a saving of from £130,000,000 to £150,000,000 per annum; that is to say, the low American rates mean a saving of £2 per head of the population as against the rates charged in England. If we only realise one quarter of the saving in New South Wales it would mean a saving of half a million a year. Of course, having been in America, I am perfectly conversant with this question, and any American who came here would tell you that the hauling of big loads, and consequently of the employment of engines of sufficient power to haul big loads unassisted, is a very important thing, not only to the railways of the country, but to the people at large.

8339. *Mr. Fehon.*] Some of these engines are running on the Baltimore and Ohio, are they not? Yes; they have used six coupled passenger engines for crossing the Alleghenies for years, and have been constantly increasing their weight and power for the corresponding increase in the weight and length of their passenger trains.

8340. What is the standard weight of rail on the New South Wales railways? The old standard was 71½ lb. to the yard for steel rails, and 75 lb. for iron rails, and the present standard is 80 lb. for steel rails.

8341. And what is the standard of the spacing of the sleepers? The present standard is 2 ft. 7 in.

8342. And is not the ballasting good and equal to the best of American roads, or even to the average of English roads? Yes; I think, taking the line from Penrith to Bathurst, over which I rode some little time ago with the special object of noticing the permanent way, I may safely say that I never rode over an equal length of line upon which so much work had been bestowed within the last two years by way of draining and ballasting and renewing rails and sleepers.

8343. Do you know the weight of the Baldwin engines now running in New South Wales;—what is your

your opinion of them, taking into consideration the roads over which they have to run ;—do you consider the engines suitable for the roads and the roads for the engines? I think they are eminently suitable, and that they will produce very important economical results; that they will save time, increase punctuality, and prove a great convenience not only to the Railway Department, but to the people of New South Wales.

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8344. Do you know the builders of these engines? Yes; I visited their works very often, and I know the members of the firm, or at least some of them. They are very fine works—the largest locomotive works in the world, and the firm has a very high reputation indeed. The works are about four times larger than any works in Great Britain, and about three times as large as any other locomotive works in the United States.

8345. Then, if you ordered these engines from that firm you would have ordered them without troubling very much about supervision. In fact, you would take it for granted that they would only supply you with a first-class article, and that it was unnecessary to employ an inspector on the spot? Yes, I should take it for granted that they would give me a very good design, and put the best workmanship into the engines without supervision. I may add that it is not the custom in America when ordering locomotives to send in an inspector to see them built. I was an inspector of locomotives for some years at home, and I must say this, that I never would order a locomotive from a firm that I was not prepared to trust without the presence of an inspector. You send an inspector to supervise the building of a locomotive, and he is but one man among some thousands, and you may take it for granted that if those men do not know their work he certainly cannot teach them.

8346. Did you make some alterations in the specifications of these engines, and if so, for what reason? Yes, I did. I know there are divers opinions of steel fire-boxes and iron tubes; they are very much cheaper, and they have many advantages over copper, but where there is lime in the water they have a very short life. Now copper, while it is heavier and more expensive than steel, and in many respects an inferior material for fire-boxes, has this advantage,—that it disregards to a great extent the presence of lime in the water. If you have perfectly pure water and a steel fire-box, a person inspecting it after sixteen or seventeen years wear would not be able to tell that it had been in use for more than six or seven months; but, on the other hand, if there is lime in the water, it will wear out possibly in six months. With regard to the screw reversing-gear, I may say that, personally, I prefer it to a lever, but apart from that, there are two very strong reasons why we should adopt it in this case. First of all, nearly all our engines have screw reversing-gear, and consequently our men are accustomed to it, and secondly, on our steep gradients it is advisable to have every possible appliance for stopping an engine. If a brake gives way or is out of order you have to reverse your engine at once, and sometimes it is almost impossible to do so as quickly as is necessary if your engine is only fitted with a lever; but a screw is always easy to handle because you have so much power over it; and, consequently, under the circumstances to which you have referred, with a screw you can act with greater certainty. Then there is another thing, though it very rarely occurs. Sometimes you cannot shut steam off your engine, and under those circumstances it is very necessary to be able to reverse without a moment's delay, because an engine running down an incline with steam on in forward gear cannot be held by the brake. The other alterations made in the specifications are not of much importance, and I do not think it is necessary for me to refer to them in detail.

8347. Was the design of this engine entirely original, or was it suggested by that of an engine already in use? It was suggested by an engine in use on the Baltimore and Ohio railway which gave very good results.

8348. It has been said that your modifications somewhat impaired the power of these engines—is that a fact? I have gone into that question carefully, and have not quite finished my investigation; but here is a diagram which may throw some light upon it. I have plotted here the horse-power and different speeds of the Baltimore and Ohio engines, and have done the same with regard to our own engines. The blue figures on the diagrams represent our engines and the red the Baltimore and Ohio engines, and the two things pretty well coincide.

8349. *Professor Warren.* Has that anything to do with the gradients, or is it simply a statement of horse-power? No; the gradients are not shown. These figures are taken from the results of a test of the Baltimore and Ohio engines and the results of the tests that we made on 11th May with our Baldwin passenger engine. I may say with regard to tractive power, that of course is the most important feature in locomotives for heavy gradients, that our engines develop a greater maximum than the Baltimore and Ohio engines. Our engine on 11th May developed 19,836 lb. as maximum, and the Baltimore and Ohio engines developed 19,064 lb. as a maximum.

8350. But it fell as low as 9,000 lb.? Yes; but that was before it was exerting its full power. I do not know if you have the figures of the 4th test made on May 11th when the engine was ascending the 1-30 gradient with a load of 144 tons. The tractive power varies as follows:—19,152 lb., 19,836 lb., 19,323 lb., 19,545 lb., 19,237 lb., 19,476 lb., 19,647 lb., 19,297 lb. Now the Baltimore and Ohio engines never once exerted these powers.

8351. That is merely tractive force? Yes.

8352. It has been said that these engines slipped their wheels? The engines do not slip.

8353. Therefore it does not follow that the hauling power of the train is proportionate to the tractive power? Certainly.

8354. But does it not depend on the weight on the driving-wheels, and so on? If the engine can exert that tractive force, the train will have to move.

8355. But the tractive force does not depend upon the weight on the driving-wheel; will you give me the formula from which you obtained your results? $\frac{d^{28}}{D} = \text{tractive co-efficient}$; d = diameter of cylinder; S = stroke; D = diameter of driving-wheel.

8356. Well, where does the weight of the driving-wheels come in there? It does not come in there; but if the weight on the driving-wheels is deficient, the engine will slip.

8357. Exactly, that is what I say; the weight on the driving wheel must be proportionate to the tractive power, but we have it in evidence that the engines do slip? If all the evidence you have on that point is like the evidence I heard this afternoon, it has not much bearing upon the question. It was stated by the witness who referred to the slipping of the driving-wheel that it was owing to bad cleaning, and in consequence the oil was dripping on to the driving-tire. Any engine in the world would slip under those conditions.

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conditions. I am perfectly satisfied, from my experience after riding upon the engines, and after speaking to the drivers, that they are very well proportioned and rarely slip. Indeed, their adhesive weight is rather more in proportion to their cylinder power than that of other types of engines on the line. I investigated this question some two years ago, and came to the conclusion that in this climate we could do with a lower co-efficient of adhesion than you would require in the United States or in Canada; and in the United States and Canada they can do with a lower co-efficient than they can in Great Britain.

8358. In other words, you have a "better rail"? Yes.

8359. The point is with regard to the letters that were sent by the Secretary to the Railway Commissioners to the Baldwin Company. You, in conjunction with others, advised the Commissioners as to the purchase of these engines. Did you authorise this statement?

8360. You made a report in which it is stated that these engines are expected to haul such-and-such a weight at such-and-such a speed up a certain grade? The essential statement is in a letter from the Railway Commissioners to the Baldwin Company, dated 22nd December, 1890, and found on page 4 of the correspondence.

8361. Yes, that is it; in that letter you say:—There is a mis-print in that letter. The weight should be 176 and not 178 tons.

8362. So that really it is intended to haul 176 tons up 1 in 40 at a speed of 22 miles an hour? No, I do not read it in that way.

8363. Well, let me read you another letter; this is on page 7 of the correspondence, and the letter is dated December 29th, 1890. It is from the Secretary of the Railway Commissioners to the Baldwin Company. I admit that the load which it was said necessary to haul up 1 in 40 at 22 miles an hour was not mentioned in the first letter, but it certainly is stated distinctly in this letter. So you see that in this statement to the effect that the engine will be expected to haul 176 tons up 132 feet per mile, or 1 in 40, at 22 miles an hour? [*The correspondence was then handed to the witness.*]

8364. The power of the engine is implied in this letter very distinctly? Yes, that is a little mistake. I certainly consider that the engine should haul 152 gross tons, as I stated in the former letter. I expected to be able to put on an additional car occasionally up the 1 in 40, but I hardly expected that under these circumstances the engine would keep this time. We named our very maximum requirements. The Chief Commissioner asked me before the letter was written what was the very best speed at which the load could be hauled up the gradient in question, and asked me if it could not be done at 25 miles an hour. I told him that it could not be done at that speed up that incline, and ultimately I told him that he had better say 22 miles an hour.

8365. Then we may take it that you are the author of these figures? Yes, I believe I am professionally responsible for them.

8366. And you worked out the horse-power, I suppose? Yes, and found it as stated in the letter.

8367. I may say that I have checked them and made the same difference? Yes.

8368. What horse-power did you put down? I have lost those calculations.

8369. Well, the highest horse-power recorded in the Baltimore and Ohio trials is 1,003, is there another table? Yes, there are various runs in which the horse-power is shown.

8370. I see one runs up to 1,300, but that is taken from the *Railroad Gazette*, which says that the Baltimore and Ohio engines developed 1,300 horse-power, but then that was before she had settled down to her work? Yes, that was before she struck the grade that they work out 1,300 horse-power.

8371. You know the horse-power that the New South Wales engines develop? I expected them to develop from 900 to 960 as maximum.

8371½. Yes, that is very well, but the figures you give in the letter work out considerably beyond that? I think not.

8372. I think, if you work them out by the American practice, you will find that they give a result exceeding 1,000 horse-power. It is certainly more than 1,000 horse-power to haul 176 tons up 1 in 40 at 22 miles an hour? Yes; but I did not expect them to haul 176 tons up 1 in 40 at that rate. I thought it would be a very good performance if they hauled 150 at that rate.

8373. Well, but if you work that out you will find that it comes to more than 960, I think? I think not.

8374. Of course I know there is a train resistance. However, let us take 960 as what you expected them to perform? I expected them to perform between 900 and 960.

8375. Then I will refer you to some of your own tests. Did any one of the tests made by Mr. Richardson and yourself with the ten-wheeled engine come up to 930 horse-power? No, not any of them, but you cannot develop a very great horse-power in going up a long incline with such an extreme load, as the speed is necessarily slow.

8376. That is very well, but we cannot accept that? But that is a mere statement of fact. I am telling you what the engines actually did.

8377. But if they will develop from 900 to 960 horse-power up such a steep incline as 1 in 40, why would they not develop it on the trials you had between Wallerawang and Mount Victoria? They have done it, they did it on May 11; but I did not expect them to do it with a welter weight on such as we had between Wallerawang and Mount Victoria. On that occasion we hauled heavier loads than we did on May 11, and consequently went at slower speed. Supposing the engine is exerting her very maximum tractive power but is only just moving, it is evident that if the motion is infinitely small the horse-power must be infinitely small also, although the engine is exerting her utmost tractive power. Then take the other extreme; if an engine is going at a very high velocity it will develop a high horse-power, though its tractive force will be very small.

8378. Therefore it is on the incline that we have to measure the performance? The weights that we hauled between Wallerawang and Mount Victoria were far larger than we should ever haul in actual practice, yet the engine kept time according to the time-table. I may also say that the loads were much larger than we asked the Baldwin Company to make the engines capable of hauling. The horse-power has no commercial value in locomotives. People do not know the indicated horse-power of the great majority of locomotives in the world; they have no object in finding it out, as it has no value from a pounds-shillings-and-pence point of view, and as a matter of fact it was not referred to in the whole of the correspondence between the Railway Commissioners and the Baldwin Company.

8379. But pardon me, you did mention the horse-power? No, we simply stated the load we expected these engines to haul at a given rate of speed. An engine might have indicated a very high horse-power and

and still be utterly useless for our purpose. Take an engine like the engine that won the first prize in the International Exhibition, 1862, the "Lady of the Lake." She has developed about 800 horse-power, but she would be utterly useless to us. She would barely haul her own weight up 1 in 30.

8380. Yes, but is that not apart from the question? I think not; I think it is rather an apt illustration.

8381. Well, I know the "Lady of the Lake" very well; I remember her when first she was built, and have assisted in taking her to pieces, but to compare that engine with these has nothing to do with the question; it is an absurd comparison? I think it has a great deal to do with it; if horse-power has to determine the fitness of the engine, our ten-wheeled engine and the "Lady of the Lake" are fit subjects for comparison.

8382. You are trying to show the Commission that the horse-power developed going up an incline has nothing to do with the power of the engine? I say that the horse-power is not a usual element in calculating the power of an engine on steep inclines, and that the usual criterion of the power of an engine as in the case of our engines working on exceedingly steep inclines is the weight of train hauled.

8383. Not the speed? Not the speed.

8384. Well, that is quite another matter altogether. What I want to know is why you ever put into the correspondence the speed at which you expected the engines to haul these loads up given grades, if you were quite indifferent to the speed? I do not say that we were quite indifferent to the speed; but what I do say is this: you do not buy these engines for the horse-power they exert, as you buy marine engines, because, as I have explained, the mere fact that an engine can exert good horse-power is no security that she will pull a good load up a given incline, and as a matter of fact I think these engines have quite exerted the horse-power that was expected of them.

8385. If you put your horse-power at 900 or 960 I think you are fairly within the mark? That is my calculation.

8386. They have developed that; but a great deal has been said about this horse-power, as though it had nothing to do with the question, and I do not think that evidence ought to be given to that effect. The case is good enough as it stands—quite? You take a light train and run it up the Picton bank, and you will probably obtain a higher horse-power than we developed on the 11th of May; but take a heavier train than we hauled—and an engine has taken a heavier train up—and you would probably get a lower horse-power. I say, therefore, that the horse-power up an incline has very little to do with the question. I think you will find on referring to the occasion when the engine exerted its maximum tractive power that the horse-power developed was from 730 to 860.

8387. That was the fourth test? Yes, but on a grade of 1 in 33 where the engine was exerting 4,000 lbs. less tractive force it developed 1,029 horse-power simply because it was running faster.

8388. Yes, but that was not on a grade? It was on a grade, but the engine had not dropped down to its work. The driver had not "opened it out."

8389. Yes; I understand the meaning of the horse-power there, and I should certainly take that out, as the engine had not settled down to her work; do you agree with that? In order to get an accurate statement of the horse-power, you should certainly wait until the engine had settled down to her work, but for practical purposes the speed from the top to the bottom of the incline should be taken.

8390. When you said that the engine should exert from 900 to 960, do you mean from the beginning of the incline or after the engine has settled down to her work? After the engine has settled down to her work; but I did not expect that in a gradient of 1 in 30 or 1 in 33. I only expected it to do that on a gradient of 1 in 40. I did not expect it to develop as much horse-power on 1 in 30 or 1 in 33, although it would probably develop more tractive power.

8391. We have 920 in one case. It was hardly on the incline then, and it will show that the engine could do 900? Well, I should like to say that the engine would do much better on the 1 in 40 than she did on the 11th of May. When we made the tests between Wallerawang and Mount Victoria the mean steam-pressure was never lower than 158 lb., and in two trials it was 159 lb., and in another one it was 162 lb. That was because there are very few people about the footplate and in the cab. The driver was not hampered; but on the 11th of May the fire was dead when the driver started. On one occasion he started from Picton with steam 20 lb. below the standard, and he would never have done a thing like that in running an express train; and thus the difference in the steam-pressure will make the train run faster and to develop more horse-power in ordinary work than she did in the test on May 11th up the 1 in 40 gradients.

8392. You have mentioned that, and it is quite right; but we repeated the second test because of the conditions under which it made it in the first instance? Yes, and on that fifth test the pressure never was above 155; and when the engine had fairly entered the incline, it was only 150. That sort of thing does not occur in regular work.

8393. Yes, but in the 1 in 40 she developed 1029 horse-power, what would you say to that? What I do say is this—that in ordinary working the engines do better than they do in these tests.

8394. And therefore, since she actually developed 940 up the 1 in 40, the engine is up to what you expected? It is most decidedly up to what I expected.

8395. The 176 tons at which you set down in the correspondence to the load that you required hauling up the 1 in 40 gradient slipped into the letter unawares, and as a matter of fact you did not expect it to be hauled at 22 miles an hour? I did not expect 176 tons to be taken up 1 in 40 at 22 miles an hour; I expected her to take it up a 1 in 40 without sticking, but I thought that she might perhaps lose a little time in doing it.

8396. You expected that she would pull the extra load, but at a lower rate of speed? Yes.

8397. That explains the whole thing, and it is a pity that it was not stated at first.

8398. *Mr. Fehon* (to witness).] What was the result of the modifications made by you in the specifications as tested by actual working experience? As far as I am able to judge, the modifications have somewhat improved the steaming powers of the engine. As far as I can judge, they will steam a little better than the Baltimore and Ohio engines.

8399. *Professor Warren*.] That is owing to their copper fire-boxes and brass tubes, I suppose? Yes; though I do not think there will be much difference.

8400. *Mr. Fehon*.] What is your opinion as to the effect these engines have on the permanent way? Well, I have ridden on a great many engines on a great many railways. I have ridden 1,500 miles a week, week

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week after week, and I may say this most emphatically—that better riding engines and better engines to enter a curve I never set foot upon, and I think that they must be very easy on the permanent way. I think that for these reasons:—First of all, the arrangement of their wheel-base is very good. They have a good guiding power round curves, and that is most important. I would like to point out that the highest figure in the diagram of these four typical engines shows these ten-wheeled engines. The manner in which any engine takes the curve is a very important point. Here you have the bogie with four wheels to guide it round a curve, and part of the work of guiding round the curve is done by the leading pair of drivers. If you take the Scotch-Yankee, which, I believe, is a good engine, you will find that they have only two bogie wheels to guide them round curves, and that the rigid wheel-base will make it more difficult for them to take curves. It is 2 feet 6 inches longer than the rigid wheel-base on the ten-wheel engines. If the road is going to be damaged at all it will be damaged by the leading driving-wheel; and secondly, we know that the Scotch-Yankee is heavier on the leading driving-wheel than the Baldwin ten-wheeled engine. Therefore, they are more likely to do damage to the permanent way than the ten-wheeled engines, and if anything should go wrong with the bogie—a spring break, or anything else happen—you have in the case of the ten-wheeled engine four bogie wheels to depend upon instead of two. For these reasons I consider that the Baldwin engines are easier on the curves than the Scotch-Yankees. The rigid wheel-base of the Baldwin engine is only 12 feet 6 inches, and that of the Scotch-Yankees is 15 feet. On the Monmouthshire where they have 5-chain curves—much shorter curves than any we have here—we could not use an engine with more than 13 feet rigid wheel-base, and every additional inch in the length of wheel-base tells on sharp curves. For those two reasons I calculate that the Baldwin engines are much easier than the Scotch-Yankees. Then these engines are very well equalized as far as the weight is concerned. I mean by that that the weight on the wheel-base is very well distributed among the various wheels. Often, sitting on an ordinary chair, we find that it is only resting on three legs, and that the fourth leg, instead of being on the ground, is in the air. The weight on the wheels of an English engine is not, as a rule, equalized, and they may, consequently, be compared to four-legged chairs.

8401. *Professor Warren.*] Does that apply to the newly imported engine? It does to a certain extent; but I am speaking of English engines generally, which are not so well equalized as American engines. If you take a three-legged stool you may pitch it down anywhere and it will always take a bearing on three points, however uneven the surface, and that is the principle upon which the American engines are built. The wheels of these engines are so equalized that the engine is, in this respect, like a three-legged stool. Put them down as you will, all the wheels bear equally on the rails. It is a very important principle indeed, and it is one that is recognised by the Scotch and English engineers in charge of the Canadian railways.

8402. Yes, but that applies to American roads, which are very bad ones; ours are the best roads in the world? I should be very sorry to say that ours are the best roads in the world. I admit that they are well sleepered, well ballasted, and well looked after generally; but you cannot call any road first-class in which there are 8-chain curves and 1 in 30 gradients on the main line. I say that our road, taking only the gradients and curves into consideration, renders the Baldwin engines very valuable. There is another point. All American engineers are of opinion that equalisation has a very powerful effect in preventing the engines slipping. Engines in which the weight on the wheel varies are apt to commence slipping, while with a constant weight on the wheels they do not slip. Now it is obvious, that, putting out of the question the permanent way, putting out of the question the curves, equalisation is a very important factor in that respect, because we want engines to pull. We have grades here steeper than any road over the Alps; we have steeper grades and a greater total height to surmount.

8403-4. *President.*] Would it be convenient for Mr. Neale to come on Tuesday. Mr. Brown, who has been obliged to leave the meeting, wants to ask him a few questions, and Professor Warren, I believe, proposes to examine him further.

8405. *Mr. Fehon.*] I have also a good many questions to put to Mr. Neale.

8406. *President.*] Well, if Mr. Neale can attend again on Tuesday we had better adjourn the inquiry at this stage until . . . Will Mr. Eddy be able to attend then?

8407-8. *Mr. Fehon.*] Yes, I think so.

8409. *President.*] He is better, is he?

8410. *Mr. Fehon.*] Yes; but he has not been at the office at all during the week.

8411. *Professor Warren.*] Have you any other witnesses to call, Mr. Fehon, besides Mr. Neale and Mr. Eddy?

8412. *Mr. Fehon.*] No, I think not.

8413. *Professor Warren.*] I should like Mr. Deane to be here again.

8414. *Mr. Fehon.*] Oh, we can get him easily.

8415. *Professor Warren.*] Then the secretary will give him notice, because Mr. Eddy will not be very long under examination, I suppose; and Mr. Deane's further examination will not take more than half an hour.

8416. *President.*] If Mr. Eddy is not able to come on Tuesday, we shall want him to come some other day. We do not wish to bring him here if he is not quite better; but we should be glad to know when he will be able to come.

8417-18. *Mr. Hoyle.*] Before we adjourn, I would like to ask this one question. There was a great deal involved in Mr. Eddy's statement that one cannot get out in cross-examination, and I want to know whether, when the case for the Railway Commissioners is over, I shall be allowed to get into the box and make a statement, which will be a sort of review of the evidence given up to the present. I should also like to put in certain evidence as to the weight of rails being used in America, the spacing of the sleepers there, and other information in connection with the whole inquiry.

8419. *President.*] I thought, Mr. Hoyle, that you had finished your case, and that it was understood that you would not call any more evidence?

8420. *Mr. Hoyle.*] I do not propose to call any further witnesses; but I am asking now whether the Commission will allow me to make a personal statement, in the nature of a reply to the evidence that has been given by the Railway Commissioners. Mr. Eddy made a very powerful and carefully prepared statement, traversing a very wide range of subjects connected with railway management. He had the advice of many able officers, backed by the assistance of his entire department.

8421. *President.*] Well, I hardly like to decide this matter in Mr. Brown's absence, because he may not agree

agree with my views; but as far as I am concerned, I thought that you made your statement at the outset of the inquiry, and I do not think that we want any statement in the way of advocacy. If it is part of your evidence, the Railway Commissioners are making out their case now, you having previously concluded your case. I would like you to think the matter over, and if you still wish to make a statement ask the question again on Tuesday, when Mr. Brown will be present.

8422. *Mr. Hoyle.*] Well, I would state this that many of the statements made by Mr. Eddy cannot be borne out by facts, whilst I believe that I am in a position to contradict them by a statement of facts if I am only permitted to make it.

8423. *President.*] The way in which what you seek to do is done in a court is this, you put a witness in a box, perhaps a doctor, and he is describing the effect of some poison, and you want to get in some authority who does not agree with him which is much the same as getting in a document as you wish to do in this instance. You say to him, "Have you read such and such a book," he says "Yes," or "No," as the case may be, and then you proceed to ask him whether he knows that that authority says "so and so."

8424. *Mr. Hoyle.*] Then, sir, I will make the application as you suggest on Tuesday, and if it is not granted I shall then do the best I can to get at the facts I want to adduce in the course of cross-examination; but I must say that Mr. Eddy made a very exhaustive statement which was fully published in the newspapers, and I think it is only just to myself that I should endeavour to obtain equal publicity to the facts that I am able to bring forward. The time will come when I shall have to face my constituents—I am under a pledge to do so at the termination of this inquiry—and I am naturally anxious that they should have as fair an opportunity of judging for themselves the gravity of my allegations as possible.

8425. *President.*] Quite so, Mr. Hoyle, but I have no doubt that the representatives of the press, if asked to do so, will give equal publicity to anything that you may say that they have given to the statement of Mr. Eddy.

8426. *Mr. Fehon.*] I presume, Mr. President, that Mr. Eddy is coming here for the purpose of being examined upon the statements that he made the other day.

8427. *President.*] Yes.

8428. *Mr. Fehon.*] Mr. Hoyle will then I imagine have every opportunity of eliciting any information that he desires, but I do not see how, having once finished his case, he can in fairness ask to be allowed to go again into the witness box.

TUESDAY, 31 MAY, 1892.

[*The Commission met in the Board-room, Colonial Secretary's Office, at 2 o'clock p.m.*]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

| ALEXANDER BROWN, Esq., M.L.C., J.P.

Mr. Deane, recalled:—

8429. *Professor Warren.*] I wish to ask you some questions, Mr. Deane, about the Solitary Creek and Wollondilly bridges, and especially with regard to the actual factor of safety existing in those structures at the present time;—the particular point to which I wish you to direct your attention is with regard to the maximum intensity of the tensile strength of these bridges when loaded with the Baldwin engines? I find the stress very heavy with these engines, one calculation shows it to be 8·24 tons per square inch, but I myself make it a little more than that in another calculation, indeed a good deal more, I make it up to 9 tons per square inch.

8430. That shows the tensile strength on the bottom flange of the Wollondilly bridge? Yes.

8431. What then would be the breaking strength with the range of stress which exists in the Solitary Creek bridges;—what is the breaking strength with regard to the range of stress? The breaking stress with Launhart's formula would be 15·6 tons, and that would give a factor of safety of less than two.

8432. That is to say, there is not a factor of safety of two in the bridges? Yes. That is to say, taking the more modern way of computing these things. If you merely took the breaking strength of the material itself the factor of safety would be more than I have stated. It would be undesirable to run any heavier weight upon these bridges. I do not believe there is any immediate danger, but it must be remembered that every time an engine goes over these bridges it exhausts so much of their life. I have strongly recommended that steps should be taken to strengthen them, and I believe that that is now being done.

8433. It means that when one of these bridges has had the 5,000,000 applications of its maximum stress there would be a factor of safety of 1·7? Yes.

8434. So that you recommend that these bridges should be strengthened? Yes.

8435. So that there is no allowance in these calculations for the dynamic effects, except in Launhart's formula? No.

8436. That gives practically the dynamic effect? Yes.

8437. Have you tried the Wollondilly bridges? No; I have not tried them specially. I have no particulars with me, but I have examined all the bridges to see what should be done to them.

8438. From what you saw of these bridges you recommend that they should be strengthened in a similar way, is that so? Yes, undoubtedly.

8439. The proposal that Mr. Foxlee has made to strengthen these bridges is a girder in the centre and underneath the bridges;—do you agree with that proposal? Yes. I discussed that matter with Mr. Foxlee some time ago, and that was the conclusion we came to, namely, that the bridge should be strengthened in that way. There is plenty of room between the flood level and the under side of the bridge to insert a third girder.

8440. I would like to ask you another question, Mr. Deane. Do you consider that the Board of Trade rules are good rules for determining the working stresses of bridges? Do you mean their rules for tension and compression strains?

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8441.

- Mr. Deane. 8441. Yes. I mean the rules which give 4 tons and 5 tons as the required stresses. They say nothing, you will remember, about the range of stresses or alternating stresses, but simply take the 4 tons and 5 tons?
 31 May, 1897. It is a convenient rule for ordinary structures, but, of course, it is not scientific.
8442. Have you seen formulæ that have been proposed by the French Government recently. They are recorded in *Engineering*, and were given about a couple of months ago. They give the working stresses for both iron and steel bridges? No; I do not think I have seen it.
8443. It is almost identical with Launhardt's formula. All I mean to say is that the formula given by him has become generally recognised as the proper system to go upon. It is now beyond discussion that the working strength should depend upon the range of strength, is that not so? Yes.
8444. Your keys, those in your bridge, are, I believe, 6 by 3. I am not certain what the size of the Glenlee bridges keys are. You would not think the keys excessive in this bridge? [*Plan of bridge produced.*] I think that is a convenient size, and such as would answer the purpose.
8445. If you were designing a beam so as to make it carry its greatest load would you not make the keys larger than you have done here? Theoretically, they should be larger towards the end, and I should not make them any smaller than that. I am not sure about the size of the keys in the Glenlee bridge. They are a little smaller, I believe, but I do not think that of very great importance, but I think the span is somewhat smaller also.
- 8445½. Do you not think the beam in your viaduct, and the same would apply to the Glenlee bridge, would be stiffer if the keys were made larger, and consequently the beams would carry a little more? Yes.
8446. You have made these keys smaller for convenience, I suppose? You have to take into consideration that the keys work loose occasionally; they require constant supervision to see that they are tight. If made very large they would still get loose, and, of course, the bridge would then be depending too much upon the reduced section of the girders, so that I think it would be undesirable to have them larger, or, at all events, very much larger than shown here.
8447. You have not any in the centre? No; merely in the ends. In the centre there is very little horizontal shear.
8448. Then this is designed to resist the horizontal shearing stress? Yes.
8449. Provided the bolts are kept tight there would be very little stress?
8450. I am not hinting that the bridge is not strong enough, but a question having arisen as to the bridges, I thought I would ask your opinion about it; I see that you have twice the shearing resistance in your case, besides there are only two wedges in the corbels, whereas you have four, so that makes four times the sheering resistance, and apparently there are only two attached to the end of the beam, so that you have a larger amount of sheering resistance in your viaduct? Yes; the keys are small, but in spite of that I consider that the bridge is perfectly safe. The spans are shorter, and there is also another point about it. Taking the bridge as a girder, there is an additional stringer on the top of the transomes, running along the top of the bridge.
8451. The Guard? Yes.
8452. I have to test that bridge, and work out the calculations of it, and that is the reason I have asked you the questions I have just put. There are six ironbark beams in each span, 12 x 12; they are fully 12 x 12, in the Glenlee bridge, in your case, they are slightly less; the centre ones there are 11 x 12, I think, so that there are six beams carrying the load? There is the small additional strength given by the kerb.
8453. That is only spiked? No; it is bolted through. It seems, according to this drawing, to be bolted right through, so as to form part and parcel of the structure.
8454. So that it would seem that the Glenlee bridge is as strong as your viaduct, except that there are two extra guard timbers; that should be a set-off against the small size of the keys? Yes.
8455. I think that is all I have to ask, Mr. Deane.
8456. Mr. Brown.] Do you want to ask any questions, Mr. Fehon?
8457. Mr. Fehon.] No.
8458. Professor Warren.] Do you, Mr. Hoyle?
8459. Mr. Hoyle.] No.

D. H. Neale, recalled:—

- Mr. D. H. Neale. 8460. Mr. Fehon.] Have the Baldwin engines any features in which, in your opinion, they are superior to the engines previously in use? Yes; I think they have many features in which they are superior to the other engines in use. They have, for example, a very efficient means of lagging the boiler, preventing the radiation of heat, and the regulator is also very efficient and very convenient for the driver, enabling him to regulate the motion of the engine very easily and exactly. The brake on the driving-wheels, which few of our other engines have, is of very great importance, especially on our steep inclines. These features are of course entirely independent of the great power and flexibility of the engines to which I have already alluded.
8461. Have you investigated their consumption of fuel? I have, with the Consolidation engines, and owing to the large loads they draw the consumption per unit of load hauled is 75 per cent. of that of the goods Mogul engines formerly in use.
8462. What has been your experience in other railways with new engines? It is a well-known fact that new engines always give trouble, and that is especially so in the case of a new type of engine. I have been connected with many railways, and I could give you a long list of failures in almost every part of an engine. All sorts of trouble arise with new engines, the most prevalent being inability to make steam, and the next incapacity to haul loads required of them. Many other troubles arise, the source of which it is often difficult to detect.
8463. Did the defects you have mentioned occur in engines well designed and built? Yes; it is a well-known fact that engines built by some of our most skilful engineers, and turned out of the largest locomotive shops, have had to be started with their trains by means of a pinch-bar. There have also been new engines which have thrown their coupling rods into adjacent fields. Others have frequently broken away from their tenders, although coupled together with exceedingly strong couplings, in fact, all sorts of troubles have arisen in connection with new engines.

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8464. Then do you say that engineers generally are agreed that it is practically impossible for new engines to have an entire immunity from failures? I never knew of any new engines that had such an immunity.

8465. Have the Baldwin engines on our lines shown any of the defects you have enumerated, as occurring in new engines, in your experience? No, they have not; they have steamed well, and they have pulled their loads, and shortcomings in these respects are the two most important kinds of failures that occur in new engines.

8466. Do you say that they have hauled their specified loads? Yes; and more than their specified loads.

8467. Is it not exceptional for engines to haul more than their stipulated load in regular working? Yes; it is decidedly exceptional.

8468. Do you consider that the quality of the axles could have been detected earlier than it was? No; I do not see how it could have possibly been detected earlier than it was, and I may state that I have had similar experience with regard to other engines that were otherwise well built. After running for a little time the tires all stretched and showed themselves to be soft and became loose. I do not suppose that the makers could have possibly anticipated that. I do not see how their quality could have been detected earlier than it was.

8469. Are scrap-iron axles cheaper than steel axles? No; they are dearer.

8470. It was left to the Baldwin Company to determine whether they would supply scrap-iron or steel axles, was it not? Yes.

8471-2. And you consider that they exercised proper judgment in sending us iron axles? Yes; I think they did. It is a matter of opinion whether iron or steel axles are the best, and the Baldwin Company acted on its experience, and I do not think they could have done better than they did.

8473. Then the reason for selecting scrap-iron instead of steel axles was not because there was any economy in it? Certainly not.

8474. Why are tests of scrap axles not usually made? Because a test of one axle is no certain criterion of the strength of the whole of them.

8475. Why is steel more generally tested than iron? Because a very small difference in the chemical composition, such as, for example, a fraction of 1 per cent. more or less of phosphorus in the composition of the steel would make all the difference. It is, therefore, necessary to test every batch in order to make sure of the quality of the material.

8476. Can you tell us whether iron or steel axles are more frequently used in Great Britain? Well, for the crank axles iron is very nearly as much in use in England as steel, and as this is a part which is exposed to very violent strains, and is consequently liable to fail, iron is used as the more trustworthy material.

8477. Have you any figures showing the accidents resulting from broken axles in Great Britain? Yes. I have compiled some figures on that subject from the Board of Trade returns. From these returns it will be seen that 245 leading or trailing axles were broken in ten years, and only two accidents resulted, and only one life was lost, the axle having run 619,414 miles, and being flawed.

8478. So that the chances would be about 1 in 100? Yes.

8479. *Professor Warren.*] Will you put that return in? Yes.

8480. *Mr. Fehon.*] Have you examined the driving-wheels of these engines, and do you consider them sound or not? I have, and consider them to be perfectly sound.

8481. *Professor Warren.*] Do you refer to the driving-wheels? Yes; the driving-wheels.

8482. *Mr. Fehon.*] Have you had much experience in making locomotive wheels? Yes, I have; and I understand the process thoroughly. I have had to inspect hundreds of locomotive wheels being made, and can speak with a good deal of confidence upon that point.

8483. Do you know the process by which these wheels are made? Yes; I understand the process, and I think it a very good one; I consider it to be better than the ordinary English practice, because there are no transverse welds, and therefore a faulty weld cannot be so serious as in an ordinary wheel.

8484. How do you account for what some people consider to be flaws in these wheels? In making the wheels the iron is pressed in an hydraulic press, and any surplus iron may flow over under the pressure, and consequently partly cover the spokes.

8485. Do you consider the hoop on the boss of the bogie wheels needs fastening as much as tires do;—do you consider that it should be fastened on the same way as tires? No; I do not think it at all necessary. I have seen similar hoops upon wheels elsewhere, and they have been running for years. A tire is likely and liable to be heated by the brake blocks; it is continually hammered on the rail, and that stretches it; it also gets hammered sideways on the rail, and all these things tend to loosen it, but the hoops have nothing of that kind to contend against, consequently they are not so likely to get loose as the tire is.

8486. It is a very common practice is it not? I will not say that it is a very common practice, but I have seen these hoops on thousands of wheels.

8487. Is the thickness of the smoke-box tube-plate in accordance with general American practice? Yes; I looked that question up, and went through a number of drawings of American locomotives, and I found only one that was one-sixteenth thinner, all the rest were of the same thickness.

8488. What is the height of the centre of the boiler as compared with that of other express engines? Well, it is lower than a good many express engines. For example, the Central of New Jersey, an express engine running at an extremely high speed is 9 inches higher than our Baldwin engine, Baltimore and Ohio engines, $1\frac{1}{2}$ inches higher, the New York Central engine which runs the Empire State express, the fastest train in the world, and going around numerous curves, is $10\frac{1}{2}$ inches higher. Philadelphia and Reading express is 1 foot higher. Cleveland, Cincinnati, Chicago and St. Louis express is the same as ours. The North Eastern Railway, in England, express is 2 inches higher—and one of the engines is 1 inch lower. The Great Northern Standard express engines, which have for many years run about the fastest trains in England, is $5\frac{3}{4}$ inches lower, but the wheel is 3 feet greater in diameter. Of course the vital thing in these matters is, what is the height of the centre of gravity above the rails, and I find on making an approximate calculations that the Great Northern express engine is about 3 inches higher in the centre of gravity than the Baldwin engines running here, therefore I think our centre of gravity is perfectly safe, that is to say our ten-wheeled locomotives have a lower centre of gravity than any of the English and American engines I have just quoted. The North-eastern express engine which has attained the highest speed ever made in England, 86 miles an hour, is about 6 inches higher in the centre of gravity than our Baldwin engines, and I find the same generally with regard to other engines.

8489. *President.*] Did you say 86 miles an hour? Yes; that was accurately ascertained.

Mr. D. H. Neale. 8490. Then do you consider our height at the centre of boiler excessive? Certainly not. I put in a table of figures on this point.
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New South Wales Government Railways.
Heights of centre of Boiler, Gravity, &c., various Express Locomotives.

Railways.	No. of wheels coupled	Centre of boiler above rail.	Diameter of wheels.			Diameter boiler.	Weight engine working order.	Centre of gravity above rail.	Fire-box above or between frames.	Remarks.
			Driving	Bogie.						
Central of New Jersey ...	4	ft. in. 8 6	ft. in. 5 8	ft. in. 3 0		58	55 6	5-13	Above	Runs regularly over 70 miles per hour.
Baltimore and Ohio	6	7 10½	5 2	2 6½		64	59 8	4-60	Between.	
New York Central	4	8 7½	6 6	3 0		58	57 1	5-24	Above	Runs fastest train in world over numerous curves.
Philadelphia and Reading	4	8 9	6 6	4 0		57½	50 0	5-22	Wootton above	Runs regularly over 70 miles per hour.
Cleveland, Cincinnati, Chicago, and St. Louis.	6	7 9	5 6	2 6		60	58 13	...	Between.	
Erie	6	8 5½	5 8	2 9		60	58 0	...	Above.	
North-Eastern	2	7 11	7 7½	3 7½	{ trailing- }	51	46 13	5-03	Between ...	{ Attained highest speed, 86 miles per hour, ever made in England.
Do	4	7 8	6 8½	3 7½		57½	(about) 47 10	4-79	do ...	
Great Northern.....	2	7 3¼	8 1½	3 11		50	45 3	4-79	do ..	Runs fastest train on line over sharp curves.
New South Wales	6	7 9	5 1	2 6		62	58 0	4-52	do	Has run fastest trains in England for many years.
Do	6	7 8	5 0½	.....		58	56 15	...	do	

NOTE.—The New South Wales ten-wheelers have, therefore, a lower centre of gravity than any of the above English and American engines, though the latter comprise engines running the fastest trains in the world.

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8491. Do you consider the power of the engine unduly strains the draw-gear at the rear end of the tender? No, I do not; and I have made some calculations showing the strain on the rear of the tender that is upon the couplings there. The two following tables show the maximum working strain on the draw-gear with ordinary goods trains working loads.

Gradient.	No. loaded waggons.	No. bogie brake-vans.	Weight of train behind tender.	Total tractive power of engine.	Total draft back of tender max. strain on draw-gear.	Safe load on draw-gear-quarter breaking strain on draw-hook.
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Consolidation engines.

			tons.	lb.	lb.	lb.
1-30	20	1	196	23,781	15,876	25,200
1-33	22	1	216	23,238	15,984
1-40	30	1	288	23,990	17,852	.....
1-50	35	1	336	23,181	17,136	.....
1-60	42	1	394	21,313	16,942	.....

American ten-wheeled engines.

1-30	13	1	137	18,747	11,097	.....
1-33	15	1	156	18,294	11,544	.....
1-40	20	1	197	18,152	12,212	.....
1-50	25	1	248	17,598	12,648	.....
1-60	31	1	297	16,841	12,971	.....

8492. Professor Warren.] Then will you give me the breaking strength of the draw-gear? Yes; from the table I have just quoted you will see that 25,200 lb. is the safe load on the draw-gear.

8493. Then what do you say is the breaking strain? Forty-five tons.

8494. That is about a factor of 4? Yes. These draw-hooks have all been tested, and have been found to be good iron with a great elongation. I think it is safe, certainly, at that figure. It is a strain of about 6 tons per square inch in tension.

8495. That is a steady pull of 6 tons, not a jerk? Yes, a steady pull. It would be a high strain for inferior iron, but this is as good iron as we could possibly get, we have taken every precaution to get good elastic iron, and so I think it is perfectly safe.

8496. What are the other qualities? Tensile strength in all cases above what we asked for, and so is the elongation.

8497. What did you ask for? I could not tell at the present moment, there is a little difference for the links, the draw-hooks, and the draw-bar.

8498. Mr. Fehon.] To put it in another way. How many times the hauling strength of the engine would the draw-gear be? I think the hauling power of the engine is about three-fifths of the safe load of the draw-gear.

8499. Professor Warren.] So that the other two-fifths will go for shock? Yes, and there are also springs which are supposed to take up the shock.

8500. Mr. Fehon.] Has there ever been any breakage of draw-gear since the heavier hooks have been put on? Not that I am aware of, I have never heard of any breakage.

8501. It has been alleged that negligence has been displayed in not supplying the Works Manager with a copy of the specifications of these engines when they arrived;—can you tell us what is the usual practice on English railroads in this respect? It is not the usual custom to supply the Works Manager with a copy of the specifications, for this reason, that up to the time the engine arrives the Chief Draughtsman is the

the person responsible for it. He has (under the instructions of the Locomotive Superintendent) designed it, made the drawings, and conveys instructions of the Inspector. When the engine arrives, it is turned over to a fresh officer (the Works Manager), and he, by inspecting the engine independently of the specification, is a check both on the maker and on the specification. It might be that the Chief Draughtsman had made errors in the design and also in the specification, and if the Works Manager simply saw that the engines were made in accordance with the specifications, he would not check their accuracy; but not doing so, he ascertains if the engine is fit for the work she has to do and can be sent out and maintained in order hereafter. If he finds anything wrong about the construction of the engine, he calls attention to it, and then possibly it will be found that the error has been made in the specification, and the Chief Draughtsman will then be called to account for it.

8502. Is the brake gear on the engine of a pattern used in the United States? Yes; it is of a pattern which is largely used in the United States, and it is highly esteemed, being regarded as the best in use for that purpose.

8503. Has not the question of the relative superiority of the ten-wheeled engine over the Mogul engine been discussed by the Master Mechanics' Association? Yes; I think I have the report of that discussion with me, but I cannot find it at present. [*The Report was put in later.*]

8504. Generally speaking, what was the tenor of that report? The question was discussed by the master mechanics' and whilst there was some little difference of opinion on the matter, the general consensus of opinion was in favour of the ten-wheeled engine for passenger trains. They considered that the four-wheeled bogie gave a greater margin of safety than the two-wheeled bogie. They also discussed the links which regulate the play of the bogie, and whilst there was also some difference of opinion about that, I can certainly say there is no question that vertical links are unsafe or dangerous, and riding upon the engines would show this to be the case, they ride extremely well. There is no fault to find with them. It is all very well to say that theoretically the vertical links are bad, but you must ride upon them and judge by experience; certainly, in this respect, the Baldwin engines are irreproachable.

8505. Has your attention been drawn to a discussion in the proceedings of the Master Mechanics' Association as to the weight on a wheel for given weights of rail? Yes; a report was presented and discussed in June of last year, and the report thereon was drawn up by five members, three of whom I know, personally, Messrs. Pulaski Leeds, C. E. Smart, and James Meehan. These gentlemen represented large railway companies, and had charge of about 1,000 locomotives, running on 6,000 miles of road, and they stated that they considered 14 tons 6 cwt. was a safe load for rails under 60 lb., and 16 tons for rails above 60 lb. and that was not traversed in any way whatever in subsequent discussions, though it was suggested that the tyres would wear faster with the heavier weights.

8506. Have you any figures as to the American practice on different lines as regards the weight on wheels with certain weights of rails? Yes; I have some figures, which I have taken from *Poor's Manual*, which is the standard authority in America for the earnings, history, officers, weights of rail, &c., in connection with the various railway companies. I have taken also the *Railroad Gazette* as my authority for the weights of the engines, and I find there that the relative weights are as follows:—

Railway.	Maximum weight on one axle.		Weight of steel rail per yard per ton on each wheel.	
			Lightest rail.	Heaviest rail.
	Tons.	ewt.	lb.	lb.
Central of New Jersey.....	19	14	6'3	7'1
Baltimore and Ohio.....	15	14		8'5
New York Central.....	17	16	7'4	9'0
Philadelphia, and Reading.....	17	0	6'6	10'6
C. C. C. and St. Louis.....	15	6		8'8
Erie..... about	15.	0	7'4	8'7
Atchison, Topeka, and St. Fe.....	15	9	7'2	8'4
Chesapeake and Ohio.....	15	6	7'3	9'8
Master Mechanics.....	14	18	...	...
L. and N. W. R.....	15	10	10'8	11'6
North Eastern.....	17	15	...	10'1
Great Northern.....	17	0	...	9'6
N. S. W. (10-wheeled Baldwin).....	15	5½	9'2	10'4
Eastern, of France.....	16	2	8'5	11'0

8507. Have you devoted some attention to the question of permanent-way? Yes; I have for a great many years.

8508. What have you found to be the most frequent causes of derailment? I find from the Board of Trade returns, and from such information as I can get in Sydney, that the most frequent cause is something the matter with the switches, and next to that something the matter with the fastenings of the rail. Of course there are a great many other causes, such as decayed sleepers, and the train being allowed to run at too high a speed over places where ballast has been removed for repacking, also from various other causes. I find that broken rails are a very infrequent cause of accident.

8509. *Professor Warren.*] Like axles? Yes.

8510. *Mr. Fehon.*] Are breakages of rails of frequent occurrence in England? I have searched the Board of Trade returns carefully, and I find that the total number of broken rails during twelve and a half complete years was 6,005.

8511. That is about 500 a year? About 480. There were in the North British line 898 broken rails in one year, and no one was injured. During that year there were 1,541 rails broken altogether in the United Kingdom. In the whole of those twelve and a half years these 6,005 broken rails resulted in accidents in which only one person was killed and forty-one injured.

8512. Have not the Baldwin engines up to date run over 500,000 miles on the railways of New South Wales, that is half a million of miles? Yes; I believe they have.

8513. And with the exception of the defective axles and one or two other small defects made good by the Company have they not done their work in a very admirable manner, and given the greatest satisfaction in

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in keeping time and drawing heavy loads? Yes, they have done their work in a very satisfactory manner. The return of the loads that they draw passes through my hands, therefore, I am in a position to make this statement. They have drawn the maximum load which we gave them to draw regularly day after day.

8514. Has not their performance proved a complete contradiction to everything said against them by Mr. Hoyle in his speech in Parliament on the 20th August last, which statements form the subject of this inquiry? I think most undoubtedly they have.

8515. *President.*] If Mr. Hoyle had objected to that question I should not have admitted it.

8516. *Mr. Hoyle.*] Oh, I do not object to it.

8517. *President.*] You should not put such a question to the witness, we have nothing to do with what Mr. Hoyle may have said in Parliament.

8518. *Mr. Fehon.*] Very well, I shall put a question or two in detail.

8519. *Mr. Brown.*] Oh, I do not think we require that.

8520. *President.*] We think the evidence Mr. Neale gives will be quite sufficient for your purpose. He says in effect that these engines completely answer your expectations, and are not defective in any way.

8521. *Mr. Fehon.*] Well, it was rather a comprehensive question, perhaps as you say so, I had better not refer to the subject of Mr. Hoyle's speech.

8522. *President.*] No, I think it would be better not.

8523. *Mr. Fehon.*] Then I shall refrain from referring to it.

8524. *President.*] Yes; I think it is just as well. There are three distinct matters this Commission has to inquire into, whether the engines are defective, whether they are unsuitable for the permanent way of the railways of New South Wales, and whether they are doing what was expected of them.

8525. *Mr. Fehon.*] So far as the Railway Commissioners are concerned, it takes a much wider scope; it attacks our administration.

8526. *Mr. Brown.*] We are not trying the Railway Commissioners, Mr. Fehon.

8527. *Mr. Fehon.*] You would not find them wanting if you were.

8528. *Witness.*] Since you have referred to the question of the engines doing what was expected of them, I may state that I have here a diagram showing the different loads the engines haul. It gives the tons hauled and the grades on which they were drawn. [*Diagram produced and explained to the Commission.*] The loads in this diagram are all goods train loads, taking a goods train speed, which is, of course, slow in going up an incline. Three dots indicated upon this diagram show that the ten-wheeled Baldwin engines have actually hauled these loads at a passenger speed, that it is to say, they have hauled at a passenger speed what we only expected them to haul at a goods train speed.

8529-30. *Mr. Fehon.*] With the experience of the work these engines do and the opportunities we have had of testing their suitability for the New South Wales railways, could we do better to-day, supposing the same necessity should arise, than purchase similar engines, with the exception only of stipulating for steel axles instead of iron axles? I do not think we could order more suitable engines for the New South Wales railways than the ten-wheeled and Consolidation engines we possess to-day.

8531. *Professor Warren.*] You state that the passenger engines haul a much heavier load at passenger speed than you expected them to haul? Yes; than we expected them to haul at a goods train speed.

8532. The dots on the diagram you have produced, do they show that these engines haul 150 tons at 22 miles an hour on a gradient of 1 in 40? They show that they haul a bigger load at a slower speed.

8533. That is, a load of 195½ tons at what speed? On this gradient of 1 in 40 there was a long reverse curve of 10 chains radius and a piece of 1 in 37·5 in the middle of it. They hauled that load at 12½ miles an hour, and that would equal passenger speed. All trains go very slowly over that bad piece.

8534. And you say that is better than hauling 150 tons 22 miles an hour up a grade of 1 in 40? Yes, I consider it to be better.

8535. It is a far lower horse-power? Yes; but as I have tried to explain, horse-power varies according to speed. I have plotted out the performances of the engines on this diagram which I produce. The red line on this diagram shows the performance over the Picton grade of 1 in 40; they are a little the lowest, because the fire had not burnt up. The green dots show the Baltimore and Ohio engine performances, and the black show the Wallerawang trials. It is obvious from this diagram that all these performances are nearly equal, and that there is very little to choose between them. The black curves on the diagram show the indicated horse-power. The following table shows the mean results obtained on the trials of a Baldwin 10-wheeled engine on May 15th of this year, of the Baltimore and Ohio engines in May, 1891, and the Wallerawang trials on April 11th, 1892.

No. of Test.	Maximum Grade.	Mean speed whole length of gradient.	Mean Boiler Pressure.	Mean Initial Pressure.	Mean I.H.P.*	Mean Tractive Power,*	Mean speed at which diagrams were taken.
<i>Picton Trials (N.S.W.), May 15, 1892.</i>							
		m.p.h.	lb.	lb.		lb.	m.p.h.
1	1-40	18·5	146	137	812	17,661	17·23
2	1-40	20·15	148	137	830	16,461	18·90
5	1-40	21·09	149	133	874	16,270	20·30
3	1-30	18·87	155	142	865	18,064	18·0
4	1-30	16·71	153½	143	777	19,455	15·0
<i>Baltimore and Ohio, May, 1891.</i>							
2	1-46·3	.....	150	.....	968	15,676	23·4
3	1-46·3	22·0	146½	.....	857	16,656	19·3
4	1-46·3	.....	149	.....	825	18,420	16·8
5	1-46·3	19·7	.....	.....	791	16,945	17·6
6	1-56	18·5	157	.....	933	17,288	20·3
<i>Wallerawang Trials (N.S.W.), April 11, 1892.</i>							
1	1-33	.....	162	.....	754	19,500	14·5
2	1-40	.....	159	.....	652	19,600	12·5
3	1-50	.....	159	.....	694	18,250	14·3

* These figures are mean results obtained on the last 1¼ or 2 miles of gradient.

8536. I should say that since I was last under examination I have studied the report of the Baltimore and Ohio trials, which I think the Commission has already seen, and the result of my examination is that I find a little different value should be attached to that report with regard to the speeds stated therein. We intended that the speed of 22 miles an hour should refer to the speed from the foot to the top of the incline of the 1 in 40. The Baltimore and Ohio Company in their trial seem to refer to the speed from the station near the bottom of the incline to the station near the top. The whole incline averages 1 in 51, whereas they give the maximum of 1 in 45. It is evident to my mind that you cannot judge of engines from expectation, you must judge from what they have actually done, and the diagram I have explained to the Commission shows what they have actually done. I dare say that the Baltimore and Ohio engines had not been tested in that accurate way previous to May, 1891, and it was quite allowable under the circumstances for the general superintendent of motive power of that line to speak in the way he has done, as quoted in Messrs. Towns' letter of December 15, 1890. It was merely a point of scientific interest to ascertain what was the speed obtained on that portion of the line on a grade of 1 in 40. For example, if the Chief Commissioner were to say, "I want a train to run from Penrith to Katoomba at 20 miles an hour," he would not tell you the exact speed on any particular incline, but would only allude to the train arriving within that time at the particular station indicated; that I think was how this misapprehension has arisen.

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8537. *Professor Warren.*] Where engines haul a load up an incline, is not the speed proportionate to the horse-power exerted? Yes, and the result ought to be the same with the same engine and the same gradient, but here we have to compare different gradients and different engines.

8538. The load of 152 tons at 22 miles an hour up a grade of 1 in 40, does not that really express the maximum hauling power of that engine at that speed? Yes.

8539. So that we are not confounding it with other grades? Messrs. Towns & Co., in their letter of 15th December, 1890, quote a letter from the Baldwin Works, as follows:—"In order to compare the stipulated performance with what the B. and O. engines are actually performing in daily service, we telegraphed the general superintendent of motive power of that company, enquiring as to the latter, and have the following telegram in reply:—'Have never had maximum load weight taken up 17-mile grade by 1,300 class engine. It is about 240 net tons at schedule speed of 22 miles per hour, exclusive of weight of engine and tender. The 240 tons of 2,000 lbs. are equal to 214 tons of 2,240 lbs. There is much curvature on the 117-ft. grade, and we are informed that in some places the actual grade considerably exceeds 117 feet per mile. The latter is the theoretical grade, as shown by the profiles.'"

When he says that, he does not say that it is on the 117-ft. grade that the speed was 22 miles an hour, but that the speed from Piedmont to Altamont, 16·8 miles distant, is 22 miles an hour. Now a great deal of that distance is on a grade of 1 in 45, and some of it 1 in 132, but the average is 1 in 51 and not 1 in 45.

8540. You are certain of that? Yes.

8541. Could you show us a profile of it? Yes; you will find it on that page of the report of the Baltimore and Ohio trials in your hand. The height of each station above the sea is given in the profile, and the distances are given in another table. By dividing one with the other I get an average of 1 in 51, and it is on that that a speed of 22 miles per hour was obtained. It is true that upon this piece of road there is a grade of 1 in 45, but the actual speed there is 19·8 miles.

8542. Does not the letter imply that it is on a grade of 1 in 45? Yes; it is not quite clear, but I never expected the engines to do that. Only a few years ago it was very doubtful whether it was possible for an engine to indicate 1,000 horse-power under the most favourable conditions, and to expect an engine to realize 1,100 horse-power at a speed of 22 miles an hour is beyond reasonable expectation.

8543. Do you know the *Railroad Gazette*? Yes.

8544. Do you consider it to be a reliable paper? Yes.

8545. Then I shall quote from the *Railroad Gazette* for the year 1890, page 421, as follows:—"The Baldwin Locomotive Works built for the Baltimore and Ohio Railroad a 10-wheeled express locomotive having 21 x 26 inch cylinders, under a guarantee to haul seven passenger cars up a 117-ft. grade 17 miles long, at 25 miles per hour. This engine has been put in service, and has more than met the guarantee; it hauls readily eight cars up the grade mentioned. At that speed and up that grade the engine is performing over 1,300 horse-power of work, considering the total train load to be 440 tons. The weight on drivers is 102,000 lb. The total weight is 133,000 lb." (*Witness*): You have stated 440 tons, that is probably a misprint for 240 tons. Experiments were afterwards made by Mr. Barnes of the *Railroad Gazette*, in order to test accurately the performance of these Baltimore and Ohio engines, and he found that he did get 1,300 horse-power.

8546. Have you worked this out? Yes.

8547. Do you not think that 440 tons hauled up a 117-ft. grade of 17 miles long, at 25 miles an hour, would amount to a great deal more than 1,300 horse-power? American tons?

8548. Yes, given American tons, you see how much it exceeds our performances? Yes; but I have already stated that it is founded on a misprint.

8549. I quite agree with you that it was a misprint, it should have been 240 tons? Yes; and it is stated in the letter of December 15, 1890, that the probable maximum load was about 240 net tons, at 22 miles per hour.

8550. But the 240 tons would be about equivalent to about 1,300 horse-power, whereas the actual load they give is more nearly 1,900 horse-power? The 440 tons is evidently a mistake. The 1,300 horse-power was done, but it was when they were running at the foot of the incline on a grade of 1 in 132, at 30 miles per hour.

8551. Running down? No; running up. And the driver probably put the lever over preparatory to striking the grade, and when he did so he got that recorded horse-power.

8552. That simply means the indicated horse-power was wrongly obtained? Yes. An English locomotive superintendent, some years ago, obtained a maximum of 1,000 horse-power; but it was a *tour de force*, and he did it by putting the engine in full gear whilst running at 60 miles per hour, and at that time he obtained one diagram showing a horse-power of 1,000; but that is, I think, of no scientific value.

8553. Does not your diagram show the work that is done? Yes; but you only get credit in this diagram for the work you actually do in that particular time. Our inquiries have been directed to the engines hauling a train up the 1 in 40 grade.

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8555. And the indicated horse-power has all to do with that question? No. As I have previously stated an engine would develop its maximum horse-power running down hill or on a level at high speed, whereas we want an engine that can climb gradients.

8556. *Mr. Fehon.*] We never mentioned the horse-power in ordering engines.

8557. *Professor Warren.*] But you have what is equivalent to that, the load, the grade, and the speed.

8558. *Witness.*] Yes.

8559. And you have got a very fair bargain if you do not get any more fractures in the iron. I think the Commission by the by would like to see more of these fractures,—the fulcrum pins broken from the reversing gear for example.

8560. *Mr. Fehon.*] I think you saw the axles.

8561. *Professor Warren.*] Are there any other parts?

8562. *Mr. Hoyle.*] There are the draw-gear, the fulcrum pins.

8563. *Mr. Fehon.*] The draw-gear was acknowledged to be a mistake and was renewed at the expense of the Baldwin Co.

8564. *Mr. Hoyle.*] There is the brake gear also.

8565. *Professor Warren.*] Where did that go to, Mr. Hoyle?

8566. *Mr. Fehon.*] Well, it might be on the scrap heap; these things are not kept for inspection.

8567. *Mr. Hoyle.*] I think the Commission should see the wheels of the engine 457 about which so much has been said.

8568. *Mr. Fehon.*] Would you not like to see the one referred to in your speech, Mr. Hoyle? The one with the fourteen or fifteen broken spokes?

8569. *Mr. Hoyle.*] Don't you think you had better give my speech a rest.

8570. *Professor Warren* (to *Witness*).] You have seen these tests of the bogie axles, and I presume you have made experiments with the drop test yourself? No, I have not.

8571. Well, you saw the results? No; I think I have only heard of them; I do not think I have seen the paper containing them; I have heard about them, but I cannot give the exact results.

8572. I was going to ask you about the quality of the iron, but you can only judge by the fracture? Yes.

8573. Well, what do you think of the quality of the iron? I think it is inferior iron.

8574. Undoubtedly bad? Yes.

8575. You were speaking about the permanent way? Yes.

8576. Do you think an 80-lb. rail would be better if it had angle fish-plates, such as they have on the railways in America? That is a matter of opinion, even in America, and there may be some reason against the adoption of the angle fish-plate on these railways.

8577. *Mr. Fehon.*] There are some of these fish-plates in use upon our lines. I saw some myself on the suburban line.

8578. *Professor Warren.*] But it is not a standard here? No; the standard is the straight fish-plate, I believe.

8579. What is your opinion;—which is the best? Personally I prefer Fisher's joint underneath the rail to any fish-plate.

8580. Is that because it is stronger and stiffer? It is more logical in construction and likely to keep up better; but it is entirely unknown here.

8581. But the angle fish-plate would be stronger and stiffer than the ordinary one, would it not? Yes, but possibly there are difficulties in the way of its use here. There are a great many broken fish-plates even when the angle fish-plate is used.

8582. You know about the number of rails that have been broken on the lines over which the Baldwin engines run;—could you tell me how many have been actually broken for a certain time on the line between Bathurst and Penrith;—you keep records, Mr. Fehon, do you not?

8583. *Mr. Fehon.*] Yes.

8584. Will you supply the Commission with the number of rails that have been broken during the time that the Baldwin engines have been running, and also with the number in an equal time before they have been running, between Penrith and Bathurst.

8585. *Mr. Fehon.*] We have relaid 200 miles with new rails, so that probably the breakage would not be so numerous.

8586. *Professor Warren.*] Well, that would be so much in favour of the Baldwin engines.

8587. *Mr. Fehon.*] Yes, the breakages would be greater with the old iron than with the present steel rails.

8588. Yes? Our experience is that there has been no greater proportion of rails broken with these engines.

8589. Well, the Commission would like to have that information, in order to support the evidence with regard to the weight of the rails? Yes.

8590. *Mr. Brown.*] You were largely concerned, Mr. Neale, in amending the specifications that were sent for the Baldwin engines? Yes.

8591. Are you aware of the contents of a letter of the 10th October? Will you look at that letter? Yes, I see that letter.

8592. When were you first informed of the contents of this letter of the 10th October, 1890, and also the contents of the letter of the 15th December, 1890? I believe I was informed as soon as they were received, but I cannot exactly remember.

8593. Does your memory serve you as to the intimation received by the Commissioners that the company would not guarantee the speed or efficiency of the engines if the suggested alterations in the design of the engines were carried out? Yes.

8594. Did it strike you at that particular time, on receipt of the letter of the 15th December, 1890, whether it would have been advisable for you to report, with a view to receiving a guarantee of the speed and efficiency of the engine, either when these alterations should be carried out, or if you could not get a guarantee with those alterations, then that the alterations should be done away with? No; I thought our alterations were necessary, and it did not at all alarm me that the Baldwin Engine Company could not guarantee the speed, because I thought we had put the speed very high; I had that opinion myself, and I think the Commissioners thought so also.

8595. Then you thought it was better to accept the engines as modified, rather than obtain a guarantee from the company? Yes; and because I knew that we did not want as much from the engines as the Baltimore

Baltimore and Ohio engine could do, and also, having regard to our having a copper fire-box and brass tubes, I knew that the engines would steam a little better, and beyond all that I knew that our engines in this climate would do a certain amount of work, with a less amount of weight on the driving-wheels than they would do in any country that I am acquainted with. I should have no hesitation in putting 43½ tons on our driving wheels where the Baltimore and Ohio Company would think it necessary to have 46½ tons, so I was satisfied that we had sufficient power, and consequently what was said did not alarm me.

8596. And if you had to order engines to-morrow, would you add these engines which are stock of your own type to your plant as against guaranteed engines from the Baldwin Engine Company? Yes; I think I would. I do not see anything the matter with these engines.

8597. And do you, representing the Railway Department of this Colony, think that you could afford to disregard the advice of this large company, with its large responsibility, when they gave a guarantee for an engine then running on the Baltimore and Ohio line as against one which the Commissioners had altered to their own design, and for which the Baldwin Company would give no guarantee;—if you had an opportunity of repeating the order, would you carry out the same tactics? I would certainly, because I think the engines have given perfect satisfaction.

8598. Then would you accept an engine not guaranteed from the Baldwin Company, although they being very responsible people, were prepared to guarantee another kind of engine, which they regarded as suitable for our lines? Yes; and I think we are right in doing so. If we had accepted these engines as they were we would have taken, for example, steel fire-boxes, and when we found that these boxes wore away rapidly, if we expostulated with the Baldwin Company they would say, "you have lime-water in your Colony, and you knew it when you purchased these engines, consequently you must renew these boxes at your own expense."

8599. And altogether you are satisfied? Yes.

8600. There was no inspection of these engines, and you say it was contrary to the practice in America to make any inspection? It is contrary to the usual practice.

8601. But you see it is the practice in England to have an inspection? We had an inspection when the locomotives arrived here.

8602. *Mr. Brown.*] When the engines came here they had spare axles and wheels. The expenditure for a bogie axle represents about £7, and for a driving axle about £25. That we have in evidence. It is also in evidence that the Baldwin Company sent us engines, the axles of which had to be fitted by boring out the axle-boxes from 5 to 6 inches. Now, bearing in mind that these engines came to the colony without having been inspected, contrary to the practice prevailing in England, and also bearing in mind the fact that we had engines of a similar kind here whose bogie axles had been altered, do you not think that before these engines were put on the road some precaution should have been taken in order to secure the public safety. What we find is that the public transfers the responsibility to the Railway Commissioners, and the Railway Commissioners transfer that responsibility to the Baldwin Company, and the Baldwin Company in turn transfers it to a certain firm of waggon-makers, and we do not know how many others may be behind that last firm. Taking that into consideration, do you not think that it would have been well to test these axles by the drop test hydraulic press before they were allowed to run upon our lines? No, I never heard of it being done on any railway.

8603. Supposing the Commissioners had destroyed a number of axles, representing £100 expenditure, for testing purposes, would you not consider that to be a judicious outlay. The tests were made after the mischief was done—after the axles had actually failed, and the result of those tests was to satisfy the Commissioners that the axles were made of inferior material. Well, now, looking at the responsibility of the Commissioners it would have been possible to make such a test before the engines were put in use. Do you think would it have been of any value to have made such a test? In the first place I never heard of such a thing having been done, and I do not think that anybody can be blamed because it has not been done, and in the second place I doubt if such a test would be of value, as I am not sure in my own mind that these axles were defective when leaving the Baldwin Works, or whether they were made defective since they have been here by running hot.

8604. *Mr. Brown.*] But it is a fact that these tests have been made since, I want to know from you if it was not necessary for the railway authorities to make such a test before running these engines, or whether you think it would have been judicious for them to have done so. The railway Commissioners representing the Colony sent an order to the Baldwin Company, and they sent it to some waggon-maker, and these axles come out to us without having been inspected; now remembering that the axles are a very material part of the engine, do you not think it would have been advisable for the Commissioners to have made some sort of experiment to test their quality before permitting the engines to run upon our road? It is not quite correct to say that they were not inspected, they were inspected—that is to say they passed through the usual inspection by the foremen of the workshops.

8605. *Mr. Brown.*] But the shop inspection is not the same inspection that is made in England? It is really more efficient. The person appointed to act as inspector in England often knows very little about the work that is going on, is frequently a young man just out of his time, who is sent to gain experience in this way. An inspection by the foreman in the shop where each foreman is held responsible for work done under him is in my opinion far more efficient than the inspection made in England. In a large shop where much work is going on at the same time in connection with the same contract it is impossible for any inspector to exercise a thorough supervision over the whole; he cannot be everywhere at once.

8606. *Professor Warren.*] Is what you have said your opinion with regard to Sir John Fowler's inspectors, for if it is so it seems to be a reflection upon Sir John Fowler? I do not know any of Sir John Fowler's inspectors, but I have been an inspector myself.

8607. But what you say is a reflection upon Sir John Fowler? I do not know anything with regard to Sir John Fowler's inspectors beyond this that I once met a man who was inspecting for him; he was older than myself, and no doubt he was a very efficient man.

8608. *Professor Warren.*] Was not Mr. Thow an inspector under Sir John Fowler? I believe so.

8609. Would he not have selected pieces from the axles in order to have them tested in the testing machine? I do not think so at the time he was inspector.

8610. You mean to say that Sir John Fowler does not do so? I cannot say what he does or does not do; I can only say what has been done in connection with the railway companies I have had to do with.

8611. It is well known that Sir John Fowler does select pieces; the inspection he makes is most thorough? I think you will find that his tests may be made with regard to steel axles but not with iron.

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8612. *Mr. Brown.*] But if such a test as I have alluded to and such tests as were made after the accident happened had been made prior to the accident, would not the defects in the bogie axle have been discovered? Probably they would.

8613. *Professor Warren.*] Would there be the slightest doubt about it? I think there is a doubt about it.

8614. *Mr. Brown.*] It strikes me that this particular phase of it is incontrovertible. I want to know if some such test should not reasonably have been made? I do not think you could reasonably expect anyone to do it; in all my experience I never knew anyone to do it.

8615. *Professor Warren* (placing a table of the tensile test before the witness).

8616. *Witness.*] From what part of the axle were the pieces of iron subjected to these tests taken?

8617. *Professor Warren.*] They were taken from the journal and the centre of the axle. There were a great number of pieces tested—the wheel-seat, the centre of the axle, and the centre of the journal principally.

8618. *Witness.*] The limit of elasticity seems to be fairly high in most of these cases.

8619. Would you pass such material for axles? Not some of it. I may state that I have formed a theory about the cause of this trouble, it is only a theory, however, and I have not had time to test it. These results appear to me to support my theory.

8620. What results? I see the contraction of area is $19\frac{1}{2}$, and the elongation 14 in one case, in another it is 15 and 13; the limit of the elasticity is over 11 tons per square inch. I do not call that such bad iron; at all events I do not think it bad enough to account for the fracture.

8621. Is the irregularity accounted for by theory? Yes.

8622. Would you take that iron for any purpose whatever, even the commonest bridge work, when it is so irregular as that? No, it is too irregular; but the question in my mind is whether that irregularity existed at the time the iron left the makers' works, or whether it was produced here by the journal running hot.

8623. *President.*] You think that the constitution of the iron was changed in the meantime? Yes, I do.

8624. What temperature would be necessary to alter the constitution of the material? The whole thing is very novel. There are a great many mysterious cases in which trouble has occurred lately of steel forgings and flanged plates failing after the steel had been tested and found right. It is only when they have been traced to their origin that they are capable of remedy. In some cases it has been found that some phosphor bronze has been used in the same furnace as that in which the material was made, and has impregnated it. If these bearings were made of phosphor bronze, then when they ran hot the phosphorus would be possibly absorbed by the journal, and would deteriorate the quality of the material. It will be noticed in these tests that pieces possibly taken from the centre were not deteriorated to the same degree as pieces taken from the journal. I merely put this forward as a theory.

8625. *Professor Warren.*] If your theory is correct, it would have made the iron cold short on the surface, though it would have remained sound in the centre? Yes.

8626. Then, if a piece were cut out in the centre, it would be good according to your theory? Yes; but it is impossible to say how far the phosphorus may have penetrated.

8627. Well, you are the first who has said anything in favour of the axle? I say it is not such iron as I would use in an axle, but a part of it is not so bad as to explain the breakage of the axle.

8628. Is it not usual to specify the ductility tensile strength of the material in your specification? I have not been accustomed to do so; it is not usual in iron axles.

8629. *Professor Warren.*] I can show you a specification of tests of iron axles? *Witness:* Ductility tests?

8630. Yes? Then it must be recently.

8631. These tests were so conclusive that it surprises me that anything has been said in favour of the material?

8632. Have you any guarantee that the driving axles are not of bad material? So far they run very freely. The driving axles are not made by the same firm as the bogie.

8633. But you have not any proof of the soundness of the material; you have not made any test up to the present time, and yet it would only cost about £24 to make it? You would have no guarantee that the whole were sound if you did test one of them. In my last examination I referred to a case where the axles of certain engines, after running very satisfactorily for some three years, commenced every one of them to break, though the axles were the largest then used in England.

8634. Were they iron? No; steel, made by a first-class firm. I found, on making inquiries, that another railway had similar trouble; the cause was unsuspected by anyone, and could not be reasonably anticipated.

8635. Is not what you were saying just now about steel due to the fact that steel must be homogeneous if it is any good at all? Yes, certainly.

8636. The want of homogeneity in steel would cause fracture? Yes.

8637. Then you believe that the present driving axles are all right? Yes, I do.

8638. And the reason for that is that they have not given any trouble during the nine months they have been running? No; my reason for that is a great deal beyond the mere fact that they have been running for nine months without giving trouble. They are procured from as first-rate a firm of manufacturers as there is in the world.

8639. Yes, but we have had experience of that firm in the bogie axles? Yes, but everybody is apt to make mistakes sometimes; and what I mean to say is, that if you go to a first-rate firm, whilst they make a mistake once in a thousand times the probability is that nine hundred and ninety-nine times they will supply first-rate material.

8640. *Mr. Brown.*] Did we take all the precautions that we could have taken here with the bogie axles after their arrival in the Colony? Yes.

8641. *Professor Warren.*] But if the bogie axles could have been tested after they had arrived in the Colony how can you say that would not be a guarantee as to their quality? I do not know that I did say that.

8642. *Mr. Brown.*] There is not the slightest doubt about what the result would have been if the bogie axles had been tested; it has been admitted by the Commissioners that they were bad material, there can be no further question about it? You may have a number of tests and still you may have trouble; for instance, there have been nine broken shafts in the steam-ships that have come to this port, from one builder alone, and yet that builder is one of the best builders in Great Britain, and has given special attention

attention to testing steel. In this instance, no doubt the machinery was subjected to all the tests that were considered necessary, and yet the breakages have been so striking that a special report has been sent to the Board of Trade about them.

8643. *Professor Warren.*] But supposing that the tests had been made, and the results had been pretty much as represented in this list, would you have allowed the axles to run? No; I should not.

8644. *Mr. Hoyle.*] I would like to ask Mr. Neale whether this is a correct copy of the letter that he addressed to the Commissioners in respect to the Baldwin engines. You have seen this letter, Mr. Neale, is it a copy of the one to which I refer? Yes; I believe it is.

8645. I noticed in your evidence on Friday last that you used these words, "If you take the 'Scotch Yankee,' which I believe is a good engine, you will find that they have only two bogie wheels to guide them round curves, and that the rigid wheel-base will make it more difficult for them to take curves. It is 2 ft. 6 in. longer than the rigid wheel-base on the 10-wheel engines. If the road is going to be damaged at all it will be damaged by the leading driving-wheel, and, secondly, we know that the 'Scotch Yankee' is heavier on the leading driving-wheel than the Baldwin 10-wheeled engine, therefore they are more likely to do damage to the permanent-way than the 10-wheeled engines, and if anything should go wrong with the bogie—a spring break, or anything else happen—you have, in the case of the 10-wheeled engine, four bogie wheels to depend on instead of two. For these reasons I consider that the Baldwin engines are easier on the curves than the 'Scotch Yankees.' The rigid wheel-base of the Baldwin engine is only 12 ft. 6 in., and that of the 'Scotch Yankees' is 15 ft. On the Monmouthshire, where they have 5-chain curves—much shorter curve than any we have here—we could not use an engine with more than 13 ft. rigid wheel-base, and every additional inch in the length of wheel-base used tells on sharp curves. For those two reasons I calculate that the Baldwin engines are much easier than the 'Scotch Yankees.' Then these engines are very well equalised as far as the weight is concerned. I mean by that that the weight on the wheel-base is very well distributed among the various wheels. Often sitting on an ordinary chair we find that it is only resting on three legs, and that the fourth leg, instead of being on the ground, is in the air. The weight on the wheels of an English engine is not, as a rule, equalised, and they may consequently be compared to four-legged chairs.

8646. *Professor Warren.*] Does that apply to the newly imported engine? It does to a certain extent, but I am speaking of English engines generally, which are not so well equalised as American engines. If you take a three-legged stool you may pitch it down anywhere, and it will always take a bearing on three points, however uneven the surface, and that is the principle on which the American engines are built. The wheels of these engines are so equalised that the engine is, in this respect, like a three-legged stool."

8646-7. Now you say in your evidence on Friday—? There are some mistakes in that; you have not read it quite as I gave it.

8648. I read it just as it has been given to me by the officers of the Commission;—will you point out where the mistakes to which you allude are? What I said was that we used a 13-ft. wheel-base on the Monmouthshire railway, and you said that I said a 15-ft. wheel-base.

8649. Well, I will not deal with the Monmouthshire railways at all;—can you say why the "Scotch Yankee" does more harm to the permanent-way than the Baldwin engine;—is because it has a longer rigid wheel-base; and you also say that that it is a 2-wheeled instead of a 4-wheeled bogie;—will you tell me why you, believing that it is better to have a 4-wheeled than a 2-wheeled, recommended the Commissioners to take a 2-wheeled bogie instead of a 4-wheeled bogie; judging by the correspondence, you evidently recommended the Commissioners to get a 2-wheeled bogie-engine from the Baldwin Company, and now you say that a 4-wheeled bogie is better? Well, you yourself, in Parliament, stated that I "had gone one better," and the fact that I recommended a 10-wheeled engine shows that I did go one better.

8650. The fact that I did make a certain speech in the House has nothing to do with it; I am asking you questions in the course of your examination, and it is quite unnecessary to refer to anything that I may have said in the House;—I ask you the questions just as one gentleman may ask questions of another? I do not see that you can object to my reference to your speech in Parliament—you quote from my letter to the Commissioners, and I quote from your speech in the House.

8650½. Here is your evidence that you gave before the Commission on Friday last. You do not deny it, and in it you say, "If you take the "Scotch Yankee," which I believe is a good engine, you will find that they have only two bogie wheels to guide them round curves," this implying that it is better for engines to have four bogie wheels, and yet you recommend the Commissioners to purchase engines with two bogie wheels;—how was that? Well, I certainly may be permitted to improve upon a suggestion; the world improves, and I hope that I do. I have explained what are the advantages of the 10-wheeled engine; I have said that it is heavier and more expensive than the Mogul; but that, after taking the question very carefully into consideration, the Master Mechanics' Association (than which I should wish for no better authority) decided that the balance of advantages lay with the 10-wheel engine for purposes of passenger traffic. I am supported by that authority, and I do not know what more you want.

8651. Then again you say that the Baldwin engine has a 12-ft. 6-in. rigid wheel-base, and the "Scotch Yankee" has a 15-ft. rigid wheel-base;—as a matter of fact, I find that the Baldwin Consolidation engine has a rigid wheel-base 14 ft. 3 in. in length? I was talking about Baldwin passenger engines, and not Consolidation engines at all; they are very different things.

8652. Yes, but the evidence speaks of Baldwin engines;—does it not imply that you are speaking of Baldwin Consolidation engines only? Yes; I was certainly only alluding to the passenger engines at that particular time.

8653. And here again [*showing the witness a diagram of a Consolidation engine*] you say that this one has a pony truck, which you can condemn? Well, the very name Consolidation engine is enough to indicate to anyone who knows about the subject that it has a pony truck. As a matter of fact, I was only speaking about passenger traffic in this particular portion of my evidence, and drawing a distinction between a 10-wheeled engine and a Mogul, for the purpose of passenger traffic.

8654. You were simply speaking about Baldwin engines, and we must take the lot? When I referred to the 4-wheeled bogie, it must be taken for granted that I am referring to an engine with a 4-wheeled bogie, and the only engines under discussion that have 4-wheeled bogies are 10-wheeled engines. The very name of the Consolidation engine shows that they have only pony trucks.

8655.

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8655. But you said here that the rigid wheel-base of 15 feet in length on the "Scotch Yankees," is injurious to our curves. The Consolidation engine has a rigid wheel-base of 14 ft. 3 in. Now, if a rigid wheel base of 15 feet is injurious to the curves, is not a rigid wheel-base of 14 ft. 3 in. also injurious? The speed has a good deal to do with that, and you must remember that the Consolidation engines are only employed in running passenger trains up the mountains, where the speed is necessarily slow.

8656. But there are many places where the engine can travel at a high rate of speed round the curves on the mountains. For instance, at Tarana, where the accident occurred, you attain a high rate of speed? I beg your pardon; I know very few places on which it is more difficult to obtain a high rate of speed than on the road between Penrith and Bathurst.

8657. But I say that from Wallerawang to Bathurst, where the accident occurred, you were going down hill, and if a high rate of speed is possible upon any curves, it is possible there? When you are going down from Katoomba to Emu Plains you are going down hill continually, but you would not for a moment say that it was possible to attain a high rate of speed there. It certainly does not follow that because you are going down hill that you can attain a high rate of speed.

8658. What I want to know is this: If a 15-ft. wheel-base is injurious to the curves, is not the 14 ft. 3 in. also injurious to the curves? No, it is not, for the simple reason that there are thousands of these engines working with most satisfactory results. The Master Mechanics' Association highly approves of them, and in further evidence of the advantage of using them I may say that they have saved several millions of pounds sterling annually to the American people.

8659. There was nothing about speed given in the evidence by Mr. Neale on Friday, you did not qualify your statement in any way, what you did say was that engines with a 15-ft. wheel-base were injurious to the curves, and now I ask you why a wheel-base of 14 ft. 3 in. will not be injurious to the curves also? My answer to that is that engines with a rigid wheel-base of 14 ft. 3 in., if run at a limited speed, are not injurious, and we know, as a matter of fact, that these engines are run at a limited speed.

8659½. Then would the "Scotch Yankees" be injurious to the curves when run to moderate speed? Well, not if run at a moderate speed, though, as they are 15 feet the wheel-base, they will be more injurious than the Baldwin engines, as every additional foot tells; but I was not speaking of goods engines at all—I was speaking of passenger engines.

8660. *Mr. Fehon.*] This is a very unfair comparison to make. Mr. Hoyle is pitting the rigid wheel-base of a goods engine against the rigid wheel-base of a passenger engine.

8661. *President.*] What Mr. Neale says is that although my previous evidence bears the construction that Mr. Hoyle put upon it, as a matter of fact, I did not mean that it should have that construction. I was comparing a Baldwin passenger engine with Mogul engines, and not referring to goods engines at all.

8662. *Mr. Fehon.*] Yes, but the engine which Mr. Hoyle was referring to is an engine that runs at a low rate of speed, whilst the "Scotch Yankee" is a passenger engine, and an engine that runs at a high rate of speed.

8663. *President.*] We shall see that when we come to read through the evidence. There is no need for any explanation about it at all.

8664. *Mr. Hoyle.*] With regard to these axles, I should like to know whether Mr. Neale has any guarantee that the axles supplied by the Baldwin Company were not a lot that they had on hand, and were not specially made for these engines at all.

8665. *Mr. Brown.*] How can he tell whether they were or were not made specially for these engines?

8666. *President.*] Of course he has no guarantee. That is quite plain. We can see that. The evidence upon that point was given by Mr. Eddy, or Mr. Rhodes, of the Baldwin Company, who said that the axles were not made by them, but were got by them from a firm upon whom they placed entire reliance. They could not tell you more than that. That is all they know themselves.

8667. *Mr. Hoyle (to Witness).*] Do you consider that iron is as good as steel for axles? It is a matter of opinion. Steel is the cheapest, and therefore I generally prefer to use it for that reason.

8668. Can you tell us what was the thickness of the tube-plates of the Baldwin engines? Well, I believe that in my evidence in chief I got a little confused about that. I thought that you referred to the fire-box tube-plates, but, upon reading it over, I am of opinion that you were really referring to the smoke-box tube-plates.

8669. Yes; the smoke-box tube-plates? They are half-inch plates.

8670. Do not most of the English railway companies build their own engines? No.

8671. Well, now, in England, when an engine is being built, is it a fact that the English companies do not provide or do not insist upon some rigid inspection when the engine is being constructed? They send an inspector down to either visit the works every day or so many days every week, and he walks through the shop and endeavours to see that everything is progressing satisfactorily. He sees the boilers tested, and tries the truth of a good many measurements, and so on.

8672. You are referring now to an inspection undertaken by a person provided by the railway company themselves? By the railway company, yes.

8673. But I understood you to say before that it was only boys or young men just out of their time who were sent to the locomotive works for that purpose? Yes.

8674. You said that you were an inspector on the English railways? Yes.

8675. Was that just when you were out of your time? Very shortly afterwards.

8676. Well, do you mean to tell me that when you were out of your time you really did not know and were not capable of properly inspecting all the parts of an engine? It is not a question of whether you are competent to examine all the parts of an engine; it is a question whether you can watch work that is going on in a large number of shops, and can be sure that that work is being done honestly. It is a question of whether you can watch a couple of thousand men all on your work at the same time. You go into the boiler shop, and there may be twelve of your boilers under construction at once. At the same time there may be a large number of wheels being welded in the wheel shop. You cannot possibly see that the work that is put into your boilers is all honest work, or that your wheels are properly welded. You can only make the best inspection possible under the circumstances.

8677. But is that not better than having nobody there at all? It is a matter of custom, and in America it is a custom for the locomotive makers to take the whole responsibility upon their own shoulders.

8678. *Mr. Brown.*] Yet, if you were going to get any more engines from the Baldwin Company, that custom would hardly obtain, I imagine? That is not for me to say.

8679. *Mr. Hoyle.*] You say that there are no flaws in the wheels, but that the indications we saw only appeared to be flaws, that is to say that they are only flukes in the iron, raised by the application of the hydraulic press? Yes.

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8680. Do you not know, because I do as a mechanic, that one of the first things that a mechanic could be dismissed for would be for laying down a piece of work with galls in it. If I were foreman of a blacksmith's shop, and a man under me was laying down work with galls in it, I should dismiss him at once? Yes; but you have not seen work done by a hydraulic press. I have.

8681. And you think that those wheels are perfectly safe? I am sure that they are perfectly safe.

8682. Well, I am not? That may be; but I doubt if you have ever seen a locomotive wheel made at all anywhere.

8683. Well, that is not to the point;—relative to *Poor's Manual*, which you have quoted as your authority for the weight of these engines on the road, and for the weights of the rails? I do not think I quoted *Poor's Manual* with regard to the weights of the engines.

8684. No, I recollect you did not; but you did with regard to the weights of the rails? Yes.

8685. Well, what date was the edition from which you quoted? 1891, I think it is. It was from the last edition of *Poor's Manual* procurable; but I cannot remember whether it was 1891 or 1892.

8686. Would the information in that not be compiled for the year 1889; it would not give data for the particular year in which it was published, would it? Well, you can see what the date of the reports in it are by looking at it.

8687. But do you not think that the reports from the *Engineering News* and the *Railroad Gazette* are of just as much value as the reports in *Poor's Manual*? Yes.

8688. You have spoken about the weight of the rails in America. You told us that you have written some articles on the question. Do you know anything about the spacing of the sleepers in America? Yes; they are placed at distances varying from what would be represented by 2,000 sleepers to the mile to 2,800 to the mile.

8689. And that would be about 2 feet apart? Yes.

8690. Do you consider that a road with the sleepers placed 2 feet apart is any stronger than a road with the sleepers placed 3 feet apart? It all depends upon the sleepers, the ballasting, the drainage, the fastenings, and the tamping.

8691. Would a road in the United States with sleepers placed 2 feet apart be any stronger than a double-headed rail with 2½-in. chairs spaced 3 feet apart? What is a 2½-in. chair?

8692. Our chairs are only 2½ in. wide? Do you mean chairs weighing 25 lb.?

8693. I cannot tell you exactly what their weight is, but I suppose it would be about that, and what I want to know is whether you consider that a road such as they have in the United States, with sleepers placed 2 feet apart, would be any stronger than our double-headed rail with 2½-in. chairs, and the sleepers placed 3 feet apart? I consider that our road would be the stronger of the two.

8694. That is inasmuch as our sleepers are of ironbark, I suppose? Yes, with our ironbark sleepers, our stone ballast, our very good drainage, our roads would be, in my opinion, better than the roads in America, if even they were paved with sleepers.

8695. That is not quite what I mean. I am referring particularly to the bearing surface of the rails. In America you have sleepers from 7 to 12 inches wide? I never heard of sleepers 12 inches wide.

8696. I think I can produce evidence to the effect that sleepers are used in America 12 inches wide?

8697. *President.*] Let me tell you, Mr. Hoyle, that now is the time for you, if you have anything to bring forward in the nature of rebutting evidence to do so. You can do so in the course of cross-examination. If you have some book which shows that the sleepers in America are 12 inches wide, or that there are sleepers used in parts of America 12 inches wide, your proper course is to ask Mr. Neale if he knows that it is so. Ask him whether he knows that in such and such a book it is stated that in America there are sleepers 12 inches in breadth.

8698. *Mr. Hoyle.*] Well, I take this from the *Encyclopædia Britannica*, page 244, vol. 20; the article is contributed by four eminent engineers—D. Kinnear Clarke, C.E.; Professor A. T. Hadley; A. M. Wellington, C.E.; and S. Wright Dunning. In that article these engineers say, "The usual dimensions are 6 (sometimes 7) inches thick, 8 (sometimes 8½ or 9) feet long, and 8 to 10 or even 12 inches face. The usual rule is to place them 2 feet or less apart, and 2,640 to 2,700 to the mile. The large bearing surface thus afforded has especially favoured the use of the flat-based or Vignoles rails, and it is in exclusive use throughout North and, for the most part, South America." These eminent men further state, on page 253, that "the close propinquity of the sleepers gives much greater stiffness to the rails than comparative weights above would indicate, a 60-lb. rail being fully equivalent in stiffness and strength to an 80-lb rail, supported on chairs 3 feet between centres"? Well, that only confirms what I say. I told you that 12 inches is a most unusual width for a sleeper; the general width is from 7 to 8 inches.

8699. Well, I will take sleepers 8 inches wide. Do not you consider that road with 8 inch sleepers 2 feet apart would be stronger than our own road with the sleepers placed 3 feet apart and 2½ bearing surface provided by the chairs? From a theoretical point of view it might be stronger, but not necessarily from a practical point of view. What you have to take into consideration are the fastenings. If you had 150-lb. rails laid upon sleepers ever so broad, and they were not fastened at all, you dare not run over them, and if your fastenings, by reason of the softness of the wood or anything else, are not secured, then you have not a safe road. An engine strikes the rails as it is running, oscillating from side to side, and gradually shifts it further and further outwards, and in time if the line is not attended to, she would slip in between them. There you have an instance in which an engine comes to grief and yet not a rail has been broken. The fastenings alone are gone.

8700. *President.*] Yes, but what I understand Mr. Hoyle to mean is this: he says, supposing a rail is resting on a sleeper 8 inches wide and 2 feet apart, is that not better than a rail resting on a little chair in the middle of the sleeper, some 7 inches wide and 3 feet apart from the next chair in the rail?

8701. *Witness.*] No, I do not think it is, and for this reason: that if the rails were simply strained by a dead load of (say) 30 or 40 or 50 tons, and placed on chairs 3 feet apart, you would probably find that such a load would bend them a great deal more than if you had a flat-footed rail with sleepers 2 feet apart, but that is not what you have got to calculate for in railway work. You have to allow for a running load, not for a dead load. When you come to investigate an American line you find, probably, that not one of the

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the fastenings is perfectly secure; you find that you can draw the spikes; the spike-heads are cut by the rails, and so on, but when you walk along our road you find that the sleepers are perfectly tight, and that the fastenings are perfectly tight. That is what makes the difference. It is not the fact that the sleepers are placed so closely together. The reason they are so closely spaced in America is that they are none of them perfect. If they had such sleepers as we have they would put them further apart, but they know that they are putting down sleepers that are going to decay—sleepers out of which the fastenings are going to work loose, and therefore they put them closer together.

8702. *Mr. Hoyle.*] You assume that our fastenings are tight, and I cannot accept the statement.

8703. *Witness.*] Well, I am telling you from my own knowledge. The great complaint among permanent way men in America is that the rails are incessantly cutting into the sleepers, and that the spikes are always working out.

8704. *President.*] If they had as good wood in America as we have—if they had our ironbark, and the permanent way was as well ballasted, then, of course, sleepers placed 2 feet apart would be better than sleepers placed the distance that we place them apart. Perhaps they would be unnecessarily strong? They would to a certain extent be better, but the question would then arise whether it would be at all necessary to place them so close, and whether it would not be better to spend the money in some other direction.

8705. *Mr. Brown.*] In America I have seen sleepers placed almost on the virgin soil. The sleeper has hardly any ballast.

8706. *Mr. Hoyle.*] The article from which I have already quoted in the *Encyclopædia Britannica* states further:—"The close propinquity of the sleepers gives much greater stiffness to the rail when comparative weights above will indicate a 60-lb. rail being fully equivalent in stiffness and strength to an 80-lb. rail supported on chairs 3 feet between the centres." Would that be correct? I do not think that they say so at the present time. At the date that that was written Mr. Wellington had never been in England. I know these gentlemen well.

8707. *President.*] What heading in the *Encyclopædia Britannica* is that article under? I have quoted from pages 244 and 253, vol. 20, 1886.

8708. *Mr. Hoyle.*] I have no further questions to ask.

8709. *Mr. Brown.*] Have you any more witnesses, Mr. Fehon?

8710. *Mr. Fehon.*] I have no more witnesses.

8711. *President.*] Do you mean that you have no more witnesses to-day, or no more witnesses at all. Of course you are going to call Mr. Eddy?

8712. *Mr. Fehon.*] Well, Mr. Eddy is prepared to come, but we have no particular wish to call him unless the Commission or Mr. Hoyle desire that he should come.

8713. *President.*] Oh, Mr. Eddy must come. We understand that he is to come for the purpose of being cross-examined upon the statement that he made.

8714. *Mr. Hoyle.*] I made a request on Friday last that I should be permitted to make a statement in reply to the statement made by the Chief Commissioner. I would propose to read that statement exactly as the Chief Commissioner's was written, and either to read it or put it in as evidence in reply. I have gone to a great deal of trouble to search for information as to what is going on in various parts of the world in regard to railway matters, and as the Press gave a full report of Mr. Eddy's statement, I only ask that I may be allowed to make this statement in reply. You will remember, Mr. President, that I asked you a question on Friday, after Mr. Brown had left the meeting, and that you then said that I had better wait until to-day, and then ask it again in Mr. Brown's presence.

8715. *Mr. Fehon.*] I may say with regard to Mr. Eddy's statement that we look upon it as simply evidence. It did not travel outside the range of evidence, and if Mr. Hoyle has an opportunity of asking Mr. Eddy questions upon it, there is not the slightest objection to his doing so, and that, I think, should satisfy him, but Mr. Hoyle made his statement at the commencement of this inquiry, and if he is to make another at the termination of it, it will be necessary for the Railway Commissioners also to make a further statement, and in that case they might feel inclined to travel a little outside the range of the evidence which is before us.

8716. *Mr. Brown.*] I am very sorry, Mr. Fehon, that you have such a poor opinion of evidence as to say that the Commissioner's statement did not travel outside the ordinary nature of evidence.

8717. *Professor Warren* (to Mr. Hoyle).] Could not you give your statement in the form of evidence?

8718. *President.*] That does not make it any better. I would like to hear what you have to say in answer to Mr. Fehon, Mr. Hoyle?

8719. *Mr. Hoyle.*] It must be remembered that in bringing these charges before the Commission in the first instance, I went into the box for the purpose of stating the charges themselves, and not so much for the purpose of giving evidence upon them. Of course, whether I have made out the charges or not is not for me to say, but all the time this evidence has been going on the Commissioners have had at their command a number of very able gentlemen, who have been able to deal with it day after day. When called by me to give evidence, Mr. Eddy withheld a certain large amount of information that he subsequently gave, when giving evidence as a witness of the Railway Commissioners. Inasmuch, therefore, as the Railway Commissioners have had this large staff at their back to render them assistance, as they were able to cable to various parts of the world for information, and make a most important statement at the conclusion of my case, whilst I have had to attend here day after day, and attend to my private business as well, I ask this opportunity of reply may be accorded to me.

8720. *Mr. Fehon.*] Mr. Eddy's statement was made, not at the conclusion of your case, but at the beginning of ours.

8721. *Mr. Hoyle.*] It was practically made at the conclusion of my case. You may see, Mr. President, that whilst I was conducting this case and attending to my ordinary business, it was a very difficult thing for me to work at any information, and many things came out in the evidence given by the witnesses of the Railway Commissioners that I could not possibly be aware of, but now that the case has taken the turn that it has, and the Chief Commissioner having given the evidence that he has given in support of his case, I would ask to be allowed to make certain statements in evidence just as the Chief Commissioner has done. Considering the Chief Commissioner has had an opportunity of giving evidence twice, and I have only given evidence once, it seems to me that at present I am placed at a disadvantage.

8722. *Mr. Fehon.*] I would point out that it would be a most unfair thing for Mr. Hoyle to make a statement now.

8723. *President.*] Well, Mr. Fehon, Mr. Hoyle has made his application. You have objected to it, and Mr. Hoyle has replied to that objection. That ought to be the end of it. Do I understand, Mr. Hoyle, that you want to call further evidence?

8724. *Mr. Hoyle.*] No, I merely want to make a statement.

8725. *President.*] Well the difficulty is this. If Mr. Eddy had confined himself simply to a statement of facts that could be looked upon really as evidence, and that we could take entirely as evidence—I mean to matters that he knew himself—the commission would certainly not allow any further statement to be made. That is to say they would take your case and they would take the Commissioners' case as they stand, but Mr. Eddy in his very able statement went a great deal beyond what could possibly be evidence, by which I mean facts within his knowledge. He pointed out to us various facts in connection with the American railways and the lines across the Alps, and many other things, and he also sighted authorities from books, and under these circumstances we think the fairest thing to do is this, that Mr. Hoyle should be allowed to make his statement in answer, and we will consider, when he has made it, whether it should be incorporated in the proceedings or not. That is to say that there are certain things that are really evidence in his statement—it may be that we will allow them to be incorporated in the printed evidence, but if we find that it is a mere speech, a mere citing of authorities, or a mere academical disquisition, it is very doubtful whether we shall allow them to be incorporated in the proceedings.

8726. *Mr. Hoyle.*] I am very much obliged.

8727. *Mr. Fehon.*] I understand that we shall have another opportunity of questioning anything that Mr. Hoyle may say.

8728. *President.*] I understand that if we take Mr. Hoyle's statement in as evidence Mr. Hoyle will be cross-examined upon it in the same way as Mr. Eddy is to be cross-examined on his statement.

Mr.
D. H. Neale.
31 May, 1892.

WEDNESDAY, 1 JUNE, 1892.

[The Commission met at 2 o'clock in the Board-room, Colonial Secretary's Office.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.

A. BROWN, Esq., M.L.C., J.P.

Mr. Cowdery, recalled, said:—

8729. *President.*] I believe Mr. Cowdery you wish to make some explanation, or in some way to amend the evidence you have given? Shall I state what I wrote to you, Mr. President?

8730. In your letter to me, Mr. Cowdery, there were certain charges made against absent people, notably, I think, with regard to Mr. Whitton—and of course I could not, under the circumstances, permit that letter to be read, and I think it would be better if in the evidence you are now about to give, you should refrain from saying anything about persons who are absent from the proceedings of this Commission. I thought that instead of my reading your letter, you should make an explanation with regard to certain matters mentioned therein, and in doing so I trust you will refrain from saying anything that may in any way reflect in any way upon the people who are not here, and who, therefore, have not an opportunity of replying to your statements.

8731. *Witness.*] I will endeavour to do so. You will, I hope, allow me to refer to that letter?

8732. *President.*] Certainly.

8733. *Witness.*] In the letter addressed to the President, I said that my character as an engineer had suffered somewhat through the publication in the newspapers of certain mis-statements made by Mr. Fehon and some of the witnesses. They were, I thought, misleading statements, which I intend to correct. I have gathered my information from reports published in the *Sydney Morning Herald*.

8734. *Mr. Fehon.*] To whom do you refer?

8735. *Witness.*] In the first place I refer to the question you asked from Mr. Wearing.

8736. *Mr. Fehon.*] I submit that that is not in order.

8737. *President.*] Your explanation, Mr. Cowdery, must not be relative to the evidence given by other witnesses, but simply to the evidence given by yourself. I can only allow any explanation you have to give to that extent. As I understand your letter, you made certain explanations with regard to the railway lines being out of gauge. If you wish to explain that matter, you are at liberty to do so. You may say when you left the service or whilst the lines were under your management they were of proper gauge, you may do that, but you must not comment on any question of Mr. Fehon's or any answer given by the witnesses to him.

8738. *Witness.*] Yes; with reference to these gauges, it is well known that most of our lines are single lines, and it is quite patent to every body, I think, that it was not necessary in the case of single lines to alter the platforms in any shape or form. It would be a very simple matter to correct where these roads an inch or two outside or inside the gauge.

8739. *President.*] Were all the buildings connected with the platforms?

8740. *Witness.*] On the Murrumbidgee and Blayney lines it is a single line, and I believe no alteration was made. No alteration, I understand, was made there, but on the Illawarra railway, a portion of which is a double line, there are many stations which have been altered. If you will allow me to refer to the names of them, I will do so.

8741. *President.*] Yes, you may do so.

8742. *Witness.*] They were St. Peters, Rockdale, Hurstville, Arncliffe, Tempe, and Marrickville, all these platforms have been altered for the Baldwin engines to pass through.

8743. *President.*] Do you say they were altered for the Baldwin engines to pass through?

8744. *Witness.*] Yes, they were built by Mr. Whitton, and I had nothing to do with them. I make this statement because the whole onus has been laid upon my shoulders for the expenditure in altering these platforms. I had no objection to the width of the platforms; under Mr. Whitton the original standard gauge was Mr. Whitton's, and no other was used by me until the introduction of the first American engine, the Carlton platforms were built by me and have not been altered; the Erskineville platforms were also built by me and they have also been slightly altered for the new engines. They were quite right for

- Mr. Cowdery. for the old class of engine, which has run through them without obstruction at the time of the introduction of these new engines. Nos. 5 and 6 platforms in the Redfern station have been cut away from end to end for these new Baldwin engines. These platforms were built by Mr. Whitton. I had nothing at all to do with them. It is not Mr. Wearing's reply that I so much object to as to the answer Mr. Foxlee has given to some questions; but perhaps I cannot put the matter in that way.
8745. *President.*] You can make your explanation without mentioning any person's name. If there is anything in the evidence that calls for remark from you in opposition to it you can make it. It does not matter who gave the evidence. Make your corrections independent of any one else's statement. If anything a witness has said tends to refresh your memory, well and good; but you must not give what has been stated by any particular person in your evidence.
- 8745½. *Witness.*] Mr. Foxlee says that many of these platforms have been altered from the original standard gauge. Upon that point I wish to state that the original standard gauge was Mr. Whitton's, and no other was used by me until the introduction of the first American engine.
8746. *Professor Warren.*] You refer to the old Baldwin engine? Yes; and for them we only altered the stations of the Western line where they were supposed to run, and were in fact kept on this line. The evidence says, "Is it not a fact that as far back as 1879 the engines could not pass the structures as they existed?"
8747. *President.*] You say in 1879?
8748. *Witness.*] Yes; and it is said in the evidence to be a fact. This was before I had charge, but it is the first time I ever heard of it.
8749. *Professor Warren.*] Do you know when the new standard gauge was introduced?
8750. *Witness.*] I could not tell you exactly.
8751. *Professor Warren.*] Mr. Whitton I believe altered his gauge?
8752. *Witness.*] Not in my time. I think it was after the introduction of these wider engines. I never heard of the alteration of the gauge; it was adopted by every one up to that time. I never dreamed of altering his gauge.
8753. *Professor Warren.*] I suppose we could get that date from Mr. Deane.
8754. *President.*] I believe he has gone to Melbourne.
8755. *Witness.*] It is also stated in the evidence that to enable these engines to run on the western line the structures were altered. Now as this line was single beyond Parramatta there could not have been any necessity to alter the platform, as it would have been easy to slew the road in or out an inch or so. Again in the evidence it is reported that the width over the cylinders of some of the engines then in the Colony was slightly in excess of the width over the cylinders of the Baldwins. If this statement is true, how does it happen that in first running the American engines we had either to alter platforms or slew the roads; therefore if these engines were wider than the American engines the cylinders must have been placed at a different level in order to clear the platform. Then again it has been stated that if the structures had been to Mr. Whitton's standard width it would not have been necessary to spend one penny in altering the platforms. Now as a matter of fact no other gauge than Mr. Whitton's was ever used to my knowledge either before or after I took charge, until the arrival of the Baldwin engines. Then I altered the gauge 2-ft. 9-in. from the top of the rail to the top of the coping of the platform, and 2-ft. 5-in. from the outside of the rail to the front edge of the platform. To prove what I say here, it is only necessary to send to Redfern and ask for the gauge used by me.
8756. *Professor Warren.*] That is practically 5 feet from the centre.
8757. *Witness.*] I never gauge from the centre.
8758. *Professor Warren.*] We have had it that they were that width from the centre.
8759. *Witness.*] Yes, I daresay it would be about that.
8760. *Professor Warren.*] I quite agree with you as to the proper way of measuring the width.
8761. *Witness.*] I consider that Mr. Whitton's was a most suitable one for the then description of carriages and engines, and I believe that the present gauge has been made necessary by the introduction of the Baldwin engine and is dangerously far away for the carriages of the old stock.
8762. *Professor Warren.*] What was that gauge?
8763. *Witness.*] I would not be sure whether he measured from the inside or the outside of the rail, but I believe that 2-ft. 4-in. is the gauge.
8764. *President.*] You say it always existed?
8765. *Witness.*] Yes, twenty-five years ago I put up platforms for Mr. Whitton to that gauge. His gauge was 2-ft. 4-in.—whether from the outside or the inside of the rail I cannot say. But there are plenty of plans in the office which will show that.
8766. *Professor Warren.*] When you were Engineer for Existing Lines did you use any other gauge?
8767. *Witness.*] The gauge was never altered until the first Baldwin engine arrived, and I do not mean that nearly by me, but by anyone.
8768. *President.*] When did the first Baldwin engine come here?
8769. *Professor Warren.*] About eight years ago.
8770. *President.*] That was before the present Commissioners took office.
8771. *Professor Warren.*] So that as time went on, and Mr. Whitton found the necessities of the rolling stock required it, he altered the gauge.
8772. *Witness.*] Yes. I altered it to 2 ft. 5 in., as Engineer for Existing Lines, to allow these new American engines to pass.
8773. *President.*] Had Mr. Whitton anything to do with the new engines?
8774. *Witness.*] He was constructing the new lines, and he had information of the width, and, I suppose, he altered the platforms accordingly. I do not know what he did.
8775. *President.*] You say you altered the width to allow the old Baldwin engines to pass.
8776. *Witness.*] Yes.
8777. And about the same time Mr. Whitton altered his gauge? I do not know that he did so, but, I think, he did, because he had information of the width of these engines. I have no doubt that he did alter it, but I cannot say positively. I was saying that Mr. Whitton's gauge was a most suitable one for the description of carriages of the old stock, and the present gauge which has been made necessary by the introduction of the Baldwin engines is dangerously far away from the carriages of the old stock for passengers—that is to say, the gauge is dangerous for working the old stock with the new engines.

8778. *President.*] I understand by that there is a great distance between the carriage and the platform? *Mr. Cowdery.* Yes, I think so. And even with the present carriages and the present engines I have heard complaints from many passengers that they are inconveniently far away from the platforms when passengers are stepping in or out of the carriages. 1 June, 1892.

8779. *Professor Warren.*] What do you think yourself? Yes, I think that is so, the width of the cylinders of the engines is of no consequence in America where they do not use platforms as we do. I may mention that some years ago two carriages were brought to this Colony, one named the "Lady Parkes" and the other the "Lady Robertson." I saw them in the yard before they were placed on the line at all, and I thought that they were a great width, and so I put my rule across them, and ascertained that they were too wide for our lines, consequently the two sides had to be reduced, for they could not pass each other on the curves without touching, I mean when one carriage was on one road and one on the other. There is one of the platforms now—and I suppose it has been passed by the present Commissioners—for trains are running through it, where the gauge is 5 feet 8 $\frac{3}{4}$ inches in one place and 5 feet 10 inches in another.

8780. *Professor Warren.*] Where is that?

8781. *Witness.*] At Croydon, that is to say, it is out of gauge 3 $\frac{1}{4}$ inches in one place and 2 inches in another place—it is an old platform, and one end of it has been altered.

8782. *President.* Is it only in course of construction or is it going to be finished? The old and the new wall are blended together as if it were finished and the trains are running through at the present time, I may say that it is with the greatest reluctance that I have come to this room at all, and I should not now be here only that I thought an injustice had been done to me by what had been said.

8783. *Mr. Fehon.*] You say you think an injustice has been done to you? Yes, I do.

8784. Well, you have done it yourself by the way you have given your evidence? In what way?

8785. By not stating the facts thoroughly with regard to these platforms? It has been put in such a way that I am made to appear entirely responsible for the expense which has been gone to in altering these platforms.

8786. How many have you put up under your own superintendence? I do not know, but they were put up in accordance with the dimensions given to me.

8787. You put up seventy-eight, and out of the whole lot there were only two to gauge—seventy-six out of seventy-eight were out of gauge? You say I did that.

8788. Yes, or your people, those who were in your department when you had charge of it; I have a list here, and I shall read it if you like, shall I read them all?

8789. *President.*] I do not know if it is necessary to do so.

8790. *Mr. Brown.*] Read some of them.

8791. *Witness.*] They seem to be all too wide.

8792. *Mr. Fehon.*] Too wide or too narrow? A difference of an inch and an eighth might occur in the clearance of the road.

8793. You say that most of these are on the single road? Yes. The road has not been altered, but taken as a true road, and the platform has been calculated as a true platform.

8794. The road has not been shifted to meet the mistakes you made, but it has been considered to be a true road, and the platforms made what they ought to be to a true road? But you cannot get away from the fact that they are single roads.

8795. The fact that it is a single road is no excuse for it being out of gauge to meet a mistake in the construction of the platforms? Those platforms were not erected by me.

8796. All these platforms were erected during the time you were in the Existing Lines Department? Not those lines you are now alluding to.

8797. *Professor Warren.*] Speaking of Redfern and other stations near Sydney, were not these platforms put up many years ago by Mr. Whitton? Yes, many years ago.

8798. *Mr. Fehon.*] Are you aware that Mr. Whitton's gauge in 1878 or 1879 was 4 ft. 9 in. and not 5 ft. I never heard of that gauge at all; it was never shown to me in that way at all.

8799. He had two gauges, one being 3 inches less than the present standard gauge, all the alterations which had to be made in Sydney and close to Sydney were they not carried out prior to the alteration of Mr. Whitton's gauge in 1878 or 1879? The Redfern platform you are speaking of.

8800. *President.*] Were not all these platforms erected before the alteration of gauge? I do not know of any alteration of gauge in 1879.

8801. *Mr. Fehon.*] Of course, if Mr. Cowdery does not know anything about it, I will ask him no more questions.

8802. *Professor Warren.*] Mr. Cowdery, I think, would not be officially informed of what Mr. Whitton's alteration of gauge was.

8803. *Mr. Fehon.*] I presume not; but Mr. Cowdery held an important position in the service, and he ought to have known all the gauges.

8804. *Witness.*] If Mr. Whitton did alter the gauge I was never advised of it. He may have done so, but I was never informed of it.

8805. *Mr. Fehon.*] Mr. Cowdery said when he was last before this Commission that his memory was a little defective, so that perhaps he cannot remember it.

8806. *Witness.*] Perhaps. I only remember one alteration of gauge; that was when the new engines came out.

8807. *Mr. Hoyle.*] Did you make any changes at Parramatta and along the suburban line for this class of engine [*Diagram of class J, 152, put in*]? That is an American engine. It must have been for that engine that the alterations were made.

8808. These engines have been running since 1879? Then it was for them that the alterations were made. I never made any alteration after the introduction of the American engine on our line, and it was only on the Western line that I made the alterations I referred to, that is, on the line from Sydney through to the west.

8809. If the platforms were altered for these engines in 1879, and they have been admitted to be wider than the present Baldwin engines, then it would not have been necessary to alter the line to the west in order to use the present engines? No, not to alter the Western line.

8810. This diagram I may mention that engines as wide as the present Baldwin engines, if not a little wider,

- Mr. Cowdery.** wider, were running on our lines previous to the importation of the new Baldwin engines; if the line was altered in 1879 to use these engines, surely it need not have been altered in order to use engines which the Railway Commissioners have shown to be narrower? I think, if such alterations were made, it must have been because the cylinders of the recently imported engines were at a different level, and the alterations were made to enable these cylinders to clear the platform.
- 1 June, 1892.** 8811. That would have all to do with it? Yes; that is to say, the position in which the cylinders are placed in the present Baldwin engines. The new engines might be narrower over all, and still have carried the cylinders lower than the former engines.
8812. And that would have all to do with it? Yes, I suppose so. The question of the American engines coming in contact with the platforms might depend upon the bearings or the cylinders overhanging more than other cylinders have done. All these things would bring them close to the platforms in going round curves.
8813. When orders were issued for erecting platforms you always used plans? Certainly.
8814. And they were to the standard gauge of your department at that time? Certainly.
8815. And to the gauge of other platforms? Yes.
8816. And if an error were made it was made, by those who carried the work out? Certainly; I do not suppose that any of the gentlemen present expect that in the position I then held I could go out and strictly measure every inch and see if anything were carried out.
8817. *Professor Warren.*] You had competent men to do that? Yes, most competent men.
8818. *Mr. Fehon.*] And if they had been carried out to the 5-foot gauge? I do not know anything about the 5-foot gauge, it is a measurement I never heard of before.
8819. It comes to the same thing measured from the edge of the rail, or from the centre, if carried out to that gauge none of these alterations would have been necessary? I say it is wrong.
8820. *Professor Warren.*] We have not the amount of water consumed during the trial trip, Mr. Fehon, Mr. Bland promised to get it for me, but he has not done so; it is supplied, I suppose, to the Commissioners, could they get it for us? also, how many times they took water, so that we may be able to get the exact weight on the engine during the various trials; my object is simply to check the weight of the engine at the time the trials were made?

Mr. E. M. G. Eddy recalled:—

- Mr. E. M. G. Eddy.** 8821. *President.*] Mr. Eddy is now present. Mr. Hoyle desires to ask you some questions by way of cross-examination upon the statement you made before us in opening your case.
- 1 June, 1892.** 8822. *Mr. Hoyle.*] I noticed that in Mr. Eddy's evidence given a few days ago he made the following statement. And I would ask at this point that if this matter has nothing to do with the subject of this inquiry, it would be well for the Commission to state so in order that time may not be wasted by going into it. Mr. Eddy says in paragraph 6119 of the evidence:—"The failure of the various negotiations for the supply of engines to be built in the Colony, and consequent great loss of time, the rapid increase of traffic, the worn out condition of many of the locomotives, and the prospect of an exceptionally heavy wool season, rendered the immediate addition of new stock absolutely necessary. English locomotive builders being very busily engaged and consequently being unable to supply our wants promptly, the Baldwin Works were applied to and offered to deliver a large number of most powerful locomotives within an unprecedentedly short period." I ask Mr. Eddy, through you, Mr. President, if the Baldwin Co. were applied to immediately on the failure of the negotiations to have the engines manufactured in the Colony?
8823. *Mr. Eddy.*] I do not think the question is one that has been referred to this Commission to inquire into. I stated at the commencement of my evidence that to make certain things intelligible I had to ask for little latitude to be allowed me to make a few general remarks.
8824. *President.*] What have we got to do with whether tenders had been called in the Colony or not, or whether the American companies were applied to before the tenders were called or anything of that kind? How does that affect the question as to whether the engines were rightly or wrongly ordered or were defective in their working and unsuitable to the permanent-way?
8825. *Mr. Hoyle.*] That is why I raised the question. It was to have the matter decided that I raised it, because I thought that this part of Mr. Eddy's evidence was not within the scope of the inquiry, and I did not wish to transgress in that direction.
8826. *Mr. Eddy.*] I think I said in opening my evidence that I must trespass upon the time of the Commission to explain what would be otherwise unintelligible to them. I know that Mr. Hoyle, Mr. Schey, and Mr. Midelton—what I may call "a ring," an expression so common at the present time. I know that this "ring" has been scheming and plotting throughout the Commissioners' term of office, and I do object to be used in an improper way to get information from me for the use of this "ring," which has been using its best endeavours for the past three years and a half to get rid of the Railway Commissioners.
8827. *President.*] I do not think we can go into anything like that now. If I am asked to rule about it I must rule that Mr. Hoyle cannot put the question; it is right out of the scope of the Commission, and having ruled that, there need be no trouble about it, no matter what the motive is, whether it is the best or the worst motive.
8828. *Mr. Hoyle.*] I can only say here, as I have said many times since the inquiry began, that I regret that I should be made the subject of insult as I have been at the hands of the Chief Railway Commissioner. As far as Mr. Eddy's remarks concern myself as being one of a "ring" who have attacked the Railway Commissioners, I deny absolutely that I have had anything to do with a "ring," I have not been a tool, nor have I been a tool of Mr. Midelton's.
8829. *Mr. Eddy.*] If you will read your speech in Parliament of March 30th.
8830. *Mr. Hoyle.*] I am in possession of the chair.
8831. *Mr. Eddy.*] You are in possession of a scoundrel. This Commission, Mr. President, has been appointed to inquire into the truth or otherwise of certain charges. I refuse to answer any questions put to me by one of our dismissed men, who entered Parliament and declared that he went there for the purpose of revenge. I decline to answer that man's questions.
8832. *President.*] I have already ruled that Mr. Hoyle could not enter upon that line of inquiry, and
after

after having ruled that there is no need for you to say anything that is offensive to Mr. Hoyle, or for Mr. Hoyle to say anything offensive to you. Supposing that he is connected with other people towards whom you have hostile feelings.

8833. *Mr. Hoyle.*] Which I say is absolutely untrue.

8834. *President.*] Supposing he was, what has it got to do with this inquiry? We want to conduct this inquiry quietly, calmly, and dispassionately. We want to see three things—whether these engines were required, are they doing the work expected of them, and are they suitable for the work; and we do not want anything else. No doubt Mr. Eddy has been very much annoyed.

8835. *Mr. Eddy.*] I am prepared to answer any questions which you, sir, or the other Commissioners put to me, but I decline to answer any such questions as those put to me by Mr. Hoyle.

8836. *Mr. Hoyle.*] I, as the son of an English gentleman, and from as good a family as anyone in this Colony —

8837. *Mr. Eddy.*] Behave yourself like a gentleman, and not like a scoundrel, then.

8838. *Mr. Hoyle.*] I now decline to cross-examine a man who has forgotten what one gentleman owes to another when he stands before a Royal Commission of the country, and forgets all the dignity of the great position he occupies. I decline to cross-examine a man who has so far forgotten himself before the public of the country.

8839. *Mr. Eddy.*] I decline to answer you.

8840. *Mr. Hoyle.*] I decline to take any notice of you. I decline to cross-examine you. I am as good a man as you are, and came from as good a family.

8841. *Mr. Brown.*] You must not turn this Commission into a bear-garden, you know. Mr. Eddy has shown a certain amount of hostile feeling.

8842. *President.*] There need be no hostile feelings here.

8843. *Mr. Eddy.*] I have no hostile feelings.

8844. *Mr. Brown.*] You have displayed them in a very marvellous way since you have been in this room, then.

8845. *Mr. Eddy.*] I am the victim of a number of men in a conspiracy.

8846. *Mr. Hoyle.*] If I were in a position, I would make you prove it.

8847. *President* (to Mr. Eddy.)] So far as I can see, I do not think that there was any reason to call for anything you have said in reference to this, whatever may be your private feelings towards any person who is opposed to you. Mr. Hoyle is now here to ask you certain questions; why cannot you answer him without anything like a feeling of warmth being imported into the matter at all. If anything you think wrong is asked you, appeal to us; but I do not think, certainly, that you should make the Commission a means of using strong language about those who are opposed to you. I make every allowance for your feelings at this time, and I sympathise with you. (To Mr. Hoyle), I think it would be better to go on, Mr. Hoyle.

8848. *Mr. Hoyle.*] No, Mr. President. There was never a man who sprang from the stock that I spring from who would ever do it. Whilst I was an officer in the service I treated Mr. Eddy with all the respect and consideration that I could. I fought as hard as any man could to make the service as perfect as it possibly could be.

8849. *Mr. Eddy.*] Is this speech to be allowed?

8850. *Mr. Hoyle.*] I decline to cross-examine Mr. Eddy any further.

8851. *Mr. Eddy.*] I say distinctly that Mr. Hoyle and Mr. Schey have done more injury in the railway service of this Colony than, if they were given ten lives, they could overcome, and that if Mr. Hoyle considers it to be the work of a gentleman to make charges in Parliament about engines that had not yet reached the Colony, and fail absolutely to prove any one of those charges; to undermine the service; to cause papers to be stolen, and get information by tampering with the men in the service; and joins with Mr. Schey to work up the Bathurst —

8852. *Mr. Hoyle.*] It is only my sense of what is due by one gentleman to another that prevents me from telling you what you are: Coward! D—d cur!!

8853. *Mr. Eddy.*] I decline to answer Mr. Hoyle.

8854. *Mr. Brown.*] Mr. Eddy, I think you lose sight of the fact that, whilst holding the high position you do in this country, yet before this Commission you are only a witness. Whilst I recognise your high position, I cannot admit any difference between you and any ordinary witness called to give evidence before us.

8855. *President.*] Would you like to put any questions to Mr. Eddy, through me, Mr. Hoyle? You can do so perfectly well through me.

8856. *Mr. Hoyle.*] No, Mr. President, I must decline.

8857. *Mr. Brown.*] There is one feature in connection with these things that I am not quite satisfied with, and that you can no doubt give me a satisfactory explanation of; I refer to the inspection of the locomotives in America. From the evidence that we have had it appears the practice is not to send inspectors to the various locomotive works in America to supervise the building of the engines, and in that way that the engines ordered from the Baldwin Company were not inspected whilst they were being built? No.

8858. And when they arrived they were put on the road, as far as I can make out, in the ordinary way. The question for me to consider is, whether it was incumbent upon you—and when I speak of you of course I mean your officials—to have had the axles tested in any way before they were put upon the road, bearing in mind the fact that some previous engines not manufactured by the Baldwin Company, it is true, and manufactured in Scotland, but engines of a similar character to the Baldwin engines, had been the cause of dissatisfaction as far as the bogie axles were concerned. Taking all these things into consideration, knowing that you had had trouble with the axles of engines of a similar class before, and knowing that these engines had been manufactured without the oversight of an inspector acting in your interest, do you think that it was incumbent on you to have subjected the axles to any test before you placed them upon the road? I think you have had evidence given before you that with steel axles you can apply a test to one axle which will indicate pretty accurately the condition of the test, that will be of value by testing one axle out of a lot. In the case of steel axles you can do that, and be pretty sure that the rest of the axles will be of the same material, but in the case of wrought iron axles the fact that one axle out of a lot has been tested and proved to be a good axle is no proof that the test of them are good; and therefore, unless you smash up the whole of your axles in the process of testing them, you could not possibly tell whether they were all good axles or not.

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Mr. E. M. G.
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8859. Yes; but the evidence is to the effect that after you had been running your axles some time you did make a test. You subjected them to a drop test and to some other tests. If your argument is a good one—if it would have been valueless to test the axles in the first instance, of what use was it to apply the tests when you did? I do not think that it would be a proper thing to break up axles sent with an engine for the purpose of testing whether the other axles were good. It is not the practice; but with regard to inspection, taking advantage of the fact that Mr. Thow was on his way to America at the time that the engines were being built, we cabled to him to get his advice as to whether an inspecting officer should be appointed to supervise the construction of the engines in the same way as our inspecting officer supervises the construction of all engines that are built in England. He cabled back to us that it was not the practice in America to inspect, and that in America the purchasers of engines trusted to the reputation of the firm with whom they placed their orders, and under those circumstances he asked for instructions, and we, not wishing to depart from the general practice, or to throw a doubt on the reputation of the Baldwin Engine Company, instructed Mr. Thow to follow the general custom in America.

8860. And you did not think it was necessary, on the part of yourselves or your officers, to subject the engines to any further inspection than the ordinary inspection to which you subject engines before they were put on the road? Looking at the reputation of the firm, no.

8861. Although subsequent evidence proved that it was advisable, and, as a matter of fact, you actually did subject the axles to a test? As they were scrap-iron axles, I did not see what could be the object of applying a test in the first instance.

8862. Yes; but we have this fact before us, that after you tested one axle the whole of the bogie axles were tested.

8863. *Professor Warren.*] Yes; but the axles had broken then. Mr. Eddy means, as I understand it, that it is not customary to test axles before they are put on the road, inasmuch as the test would mean the breaking of the axles, and that that was why it was not done in this particular case.

8864. *Mr. Eddy.*] Iron axles are better than steel. When the axle that broke was tested it was found that in its manufacture into an axle the iron had not been properly worked. When we found that the whole of the axles had been made by the same firm we thought that, as a matter of precaution, we had better remove them all for fear that there might be bad material in some of the others.

8865. *Professor Warren.*] To say that testing one of a series of scrap axles is no criterion of the quality of the remainder is rather a sweeping statement, I think, inasmuch as they were all made by one firm? I did not make that statement. What I said was, that the testing of one scrap axle does not prove the quality of another scrap axle. If you were to say to me, "Could you not apply a test which would be of advantage if you had an inspector on the ground, who told you that they were all made in the same way?" then I should say yes; a test under those circumstances might be of advantage; but inasmuch as the axles might have been made at different times, and in thirty different shops, I do not see that by taking one axle out of a lot and testing it you could obtain a standard of the quality of the other. It is simply an argument in favour of the system of inspecting engines as they are inspected by Sir John Fowler during the process of manufacture in England—a system that has been attacked here very much lately—that of having an inspecting officer on the ground.

8866. *Mr. Brown.*] You evidently had that system in your mind when you cabled to Mr. Thow, suggesting the propriety of appointing an inspector to supervise the constructing of the engines by the Baldwin Company; he told you that it was not the custom to appoint an inspector of that kind in America, and then very wisely retired from the field to await your instructions; you did not think, under the circumstances, that it would be wise to act contrary to the prevailing custom in America, and decided to throw the onus upon the manufacturers. Those are all the questions I want to ask.

8867. *Mr. Eddy.*] I saw in the newspapers something with regard to Mr. Hoyle making a statement respecting this inquiry. I raised the question the last time I had the pleasure of being before you as to making a statement at the end of the inquiry, and you said that if it were evidence you would be prepared to admit it, but that if it were not evidence you thought it would be unwise to do so. Before we leave the room, I would like to know what is going to be your decision in regard to the statement that Mr. Hoyle has asked to be allowed to make. My statement, as it is called, was my evidence, and I was prepared to be cross-examined on it at once, and to answer any question at once, though I have this afternoon objected to answering questions put in the way they were being put. Mr. Hoyle, in formulating his charge, made a statement on my evidence. I do not look upon that as a statement at all in regard to the case. Mr. Hoyle stated his case; I, on behalf of the Commissioners, when we began to place evidence before you, put the whole thing as concisely as I could, and that was done in the shape of evidence. The authorities I referred to I put in evidence, also drawings of engines and other references of that kind, so that those authorities, if it had been desirable, your Secretary could have checked, and thus arrived at the accuracy of what I said. If Mr. Hoyle is permitted to make a statement, I must ask, on the part of the Commissioners to be allowed to say something, but so far as my personal views are concerned, I think it would be better that no statement were made, because if I did make a statement I feel that it would be incumbent upon me perhaps to say something as a matter of duty that would be disagreeable.

8868. *President.*] Will I tell you exactly what happened in regard to that. Mr. Hoyle asked whether he would be allowed to make a statement. I said if it were a statement in the way of advocacy, no. I was then reminded that in the statement you were good enough to give us the other day certain authorities were referred to that Mr. Hoyle might wish to call in question, or perhaps to bring other authorities forward to rebut. I then said that Mr. Hoyle should be allowed to state what he wished, which I took to be mainly in regard to these authorities, and that if they were considered by the Commission to be strictly in reply with the statements made by you, then we would exercise our discretion as to whether his statement should go into evidence at all. If, on the other hand, he is going to say a number of things that has nothing to do with the case, then the Commission would stop him at once; but that if he was only going to quote authorities in conflict with authorities quoted by you then his statement might be made.

8869. *Mr. Eddy.*] Is he going to make his statement now?

8870. *President.*] I suppose he will, as soon as the Commissioners' case is concluded. There was a good deal of difficulty about it, but as it was thought that yours was a very able statement of the case it was considered fair if there was anything that Mr. Hoyle wished to question in it that he should have an opportunity of doing so. A good deal of your statement, you understand, was not really, strictly speaking, evidence.

8871. *President.*] Is that the case for the Commissioners?

8872.

8872. *Mr. Eddy.*] Well, the Commissioners understand that you have stopped our evidence on certain points. Mr. E. M. G. Eddy.

8873. *President.*] That is all in your favour.

8874. *Mr. Eddy.*] Yes, if you are satisfied. We of course can produce any quantity of evidence beyond what we have produced to prove what is the correct answer to these charges, but if you are satisfied that you have sufficient evidence we have no wish to further prolong the inquiry by putting any more witnesses before you. 1 June, 1892.

8875. *President.*] I will tell you exactly how the matter stands. We understood the other day that there were a number of drivers who could come and testify to the same effect that the drivers whom you have already called have testified to. We said that we did not want them, because we took it for granted that they would come here and say precisely what had been said by the drivers whom you had already called.

8876. *Mr. Eddy.*] If you are satisfied, that is all we require.

8877. *Mr. Brown.*] On that particular point we are satisfied.

8878. *President.*] We were quite satisfied that the drivers whom you were prepared to call would say what the other drivers had said, and that in saying that they would be speaking quite conscientiously.

8879. *Mr. Eddy.*] The drivers of whom I have spoken would have been able to give very much stronger evidence than those whom you have already heard; they would have testified to the quality of the engines from daily experience.

8880. *President.*] Then perhaps we had better have them. What we say is that we are satisfied that these witnesses would all testify, and testify truthfully to the good qualities of the Baldwin engines. They would say that there was apparently nothing wrong about them in construction; that they took their curves well; that they did not do the road any harm; that they were good engines to work; and were hauling their full loads. We take it that you have a large number of good witnesses who are prepared to come here and say all that; but if you want to call them, you had better do so.

8881. *Mr. Eddy.*] No; if you are satisfied on that point, we do not want to call them.

8882. *Mr. Brown.*] Have you any other witnesses?

8883. *Mr. Eddy.*] We have no further witnesses, unless there is anything that you would like to hear.

8884. *President.*] I understand then that that closes the case for the Commissioners. What do you intend to do, Mr. Hoyle?

8885. *Mr. Hoyle.*] In reference to my statement, I may say that I am in the unfortunate position of not being able to go on with it at present. I have sent it to the typewriter, and it has not yet been returned. So far as that is concerned, I am not able to go on this evening with the statement, and must ask for an adjournment.

8886. *Mr. Brown.*] Will you be able to go on to-morrow?

8887. *Mr. Hoyle.*] Yes; I shall certainly be able to proceed with the statement to-morrow. I thought I should have been able to do so this afternoon; but it is not here, and therefore I cannot.

8888. *Mr. Eddy.*] I must point out that by reason of being here to-day, the Commissioners have had to postpone the hearing of twenty-six appeals from all parts of the Colony. They have had to send all these people back into the country, and already they have been waiting for a week or two. I cannot be here to-morrow; I have got another of these Commissions to attend—a Commission that is inquiring into charges made against me of all sorts of things—and it is rather hard upon the Railway Commissioners that another adjournment should be asked for.

8889. *President.*] What day could you conveniently attend. Your convenience shall certainly be considered as well as anybody else.

8890. *Mr. Eddy.*] I have not a day; the work of the railways is in fact now a month or more behind.

8891. *President.*] We cannot help that.

8892. *Mr. Eddy.*] I have had to work all the night through to be ready with my information—night after night and Sunday too. I have not delayed the Commission for one minute. Mr. Hoyle ought also to be in the position to proceed with his case without causing delay. He has had the Court adjourned on one or two occasions; he obtained an adjournment in the first place, owing to the Tarana accident.

8893. *President.*] I want to tell you this, Mr. Eddy. It is not Mr. Hoyle who is delaying us now. Mr. Hoyle has done his share towards getting ready, but some typewriter has not got ready for him what he anticipated this afternoon. That is not his fault.

8894. *Mr. Eddy.*] I do not know. I had to write my statement with my own hand—every word of it—and if, when it was given to the typewriter, it had not been ready, I should have gone on with it.

8895. *President.*] You quite understand this—how the case has been conducted. I called upon Mr. Hoyle, first of all, to specify the charges we had to inquire into. He made his case; you made your case; and if there are certain things which have come out for the first time when you made your statement, in answer to what he has said—things which he wants in some way to qualify or contradict—I cannot prevent him doing that. I shall not let him go beyond that, however. I do not know what his statement may be. If it goes beyond the contradiction of certain new facts which you brought out in your statement, I shall prevent his stating them.

8896. *Mr. Eddy.*] It is a week since I gave my evidence. I was prepared to be cross-examined at the time. Every witness Mr. Hoyle has brought we cross-examined on the spot. He had the same opportunity of cross-examining me. He did not do so. A week has elapsed since then, and now he is asking for another postponement.

8897. *Mr. Brown.*] The fact of the matter is, that if it had not been for the fire that took place just now Mr. Hoyle would have been all the afternoon in cross-examining you, but the proceedings have broken down. Unexpectedly, he finds he is in want of his notes, and they are at the typewriter's.

8898. *President.*] There is this difficulty in the way, Mr. Hoyle, as I pointed out to you before. Supposing, for the sake of argument, Mr. Eddy had said that the spacing of sleepers on certain lines in America is so much, and you want to make out by some authority that the spacing of sleepers in America is very much less—that they are spaced at distances quoted by you from the *Encyclopedia Britannica* yesterday—the proper way, and, indeed, the only way, for you to get it in evidence is to ask, in the course of cross-examination, from Mr. Eddy or anybody you like, whether he has heard the statement quoted in a certain article that sleepers are placed in America only 2 ft. 7 in. apart, whilst he stated that they were placed 3 feet apart. In that way, you get your authority recorded in evidence, otherwise I do not see

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see how it is evidence at all. All the books that were cited by Mr. Eddy were not evidence in any way whatever. "In a Court of law in a poisoning case perhaps something of this kind would happen. A doctor has come into Court to swear that a man has exhibited signs of poisoning by strychnine, and it may be the case of the opposing counsel that the man was poisoned by arsenic, and in those circumstances the side that wanted to prove arsenical poisoning would probably say to the witness, 'Do you know such and such a book. In that book it is pointed out that the symptoms that you have described are symptoms of arsenical poisoning. How does that affect your conclusion?'" In that way the authority would be placed in evidence.

8899. *Mr. Hoyle.*] You promised that I should make a statement, Mr. President, and I concluded that in the course of making that statement I should not be interrupted. There was much in Mr. Eddy's statement that was not evidence; but in order that the public should have the benefit of it I did not rise from my seat once for the purpose of interrupting Mr. Eddy when he was reading it; and I consider that when I come to make my statement I should not be interrupted, but that when the matter came before the Commission in typewriting they might then strike out what they considered not to be evidence.

8900. *President.*] I want to point out to you what the exact position of things is. You made your statement in the beginning. You made that statement on oath, and we have got practically everything in it. Then Mr. Eddy made his statement. If you did not object to it when he was reading it, or to any part of it, I cannot help that. If you had objected to it, and the Commission had considered that it was not evidence, or that some parts of it were not evidence, they would have been disallowed. Now you say that you could make a statement. I do not know what was in the minds of the other Commissioners, but I certainly thought that if there were certain things in it that were not evidence that you would be told at once that it could not be admitted; but the other members of the Commission do not seem to agree with me. They seem to think that you were told that you might make your statement, and that afterwards, if we thought that some portions of it were not admissible as evidence, they would afterwards be eliminated. I am very sorry if you have been misled by what was said to you yesterday. What I meant to say was that if you had anything to advance in reply to any facts that Mr. Eddy brought out the first time in his statement you should have an opportunity of stating them, but not of going beyond that.

8901. *Mr. Eddy.*] And I would submit that all the evidence that I gave has been confirmed by our officers. They have been subjected to cross-examination, and if there was anything in my statement which, as I say, was confirmed by them that deserved challenge, they could have been cross-examined upon it.

8902. *President.*] Well, I do not know what Mr. Hoyle's statement is until I see it or hear it read. Then it will be necessary for the Commission to rule upon its admissibility or otherwise. I have my own views about it, but I do not want Mr. Hoyle to be misled by anything I have done. If I have misled him by any statement of mine I should be very much more inclined to give him more liberty than I otherwise should have done. I do not know what he wishes to say. He may wish to bring rebutting authority, or there may be some new fact which you mentioned that he wants to refute, and that will be allowed; but further than that, personally I shall be opposed to him going.

8903. *Mr. Hoyle.*] What I want to know is, whether I am allowed to make the statement in the first place, any whether, having made that statement, when it is placed before the Commission they will then consider the admissibility of the whole or any portion of it.

8904. *President.*] If, by making a statement, you mean that you want to make a reply upon the whole case, as far as my judgment goes I say "No." If you wish to point out that some of the facts stated by Mr. Eddy are wrong—some of the statements made by him for the first time when opening the case for the Railway Commissioners, I see no objection to your doing so.

8905. *Mr. Brown.*] Yes; but that is not the decision of the Commission; it is the decision of the President. As far as I am concerned, you may go through the whole case, and afterwards you may hand that statement in, and the Commissioners will go through it and eliminate what they consider ought not to form part of the proceedings. That is my opinion. I do not know what Professor Warren says.

8906. *Professor Warren.*] I entirely agree with Mr. Brown. I do not see that there can be the least harm in the world in Mr. Hoyle making a general statement, and I should like to hear it.

8907. *Mr. Eddy.*] In the meantime the whole of the statement having gone to the Press?

8908. *President.*] No, I do not think so. If your statement, and the majority of the Commission seem to think you can make that statement, is to be a sort of reply to the whole case, then it would be for us to consider whether they would not first hear you or any of your officers make your *resumé* of the whole case. That is what would be done anywhere else.

8909. *Mr. Brown.*] Then the Commissioners can cross-examine Mr. Hoyle.

8910. *President.*] Again?

8911. *Mr. Brown.*] Yes. My idea is that after Mr. Hoyle has made his statement Mr. Eddy might cross-examine him and then make his statement.

8912. *Professor Warren.*] If the Railway Commissioners wish to give further evidence.

8913. *Mr. Brown.*] But I should object to any more evidence coming in at all.

8914. *Mr. Eddy.*] I quite understand that if Mr. Hoyle is allowed to make a statement the Railway Commissioners will be allowed to do the same.

8915. *Mr. Brown.*] As far as I am concerned, yes. And if these statements are to be published I think they ought to be published together.

8916. *Mr. Eddy.*] I do not for one moment wish to be considered to be dictating to the Commission, and I hope that they will understand the spirit in which I make this suggestion, but inasmuch as there is a grave question as to the wisdom of Mr. Hoyle's statement being admitted, would it not be well for Mr. Hoyle to submit it to the Commission before he reads it. In that case they could consider whether it is of such a nature as it would be wise to make public; then after having considered the statement they could give their decision upon it.

8917. *Mr. Brown.*] I do not think so, because Mr. Hoyle is prepared to swear to the statement that he is going to make. Is that not so?

8918. *Mr. Hoyle.*] Yes.

8919. *Mr. Brown.*] Therefore he is in exactly the same position as you were in when you made your statement.

8920. *Mr. Eddy.*] I beg to differ. Mr. Hoyle made his statement and brought his witnesses. I made my statement and brought my witnesses, and so far as the Commission are concerned they have said the case may be

be closed this moment, but if Mr. Hoyle is permitted to sum up the whole case, and to make statements, the nature of which are not known at the present time, then we think that we should be permitted to cross-examine Mr. Hoyle, and to make a similar statement upon the whole case, but in view of the length of time that has been occupied by the proceedings up to now we should like to see them closed at once.

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8921. *President.*] Well, I have given my opinion about it. I have said that I consider that Mr. Hoyle ought only to make a statement strictly in reply. That is to say, if there are any new facts brought up by you in your statement to be refuted, or if some authority that you then quoted is to be disputed or qualified, that is, as far as I am concerned, as far as Mr. Hoyle ought to go, but the majority of the Commission do not think so. They think that Mr. Hoyle is at liberty to make any statement he likes. If it is convenient to Mr. Hoyle to hand a type-written copy of his statement in I should be very glad to see it, but the probability is that, as far as I am concerned, the whole statement would be valueless.

8922. *Mr. Eddy.*] I believe that Mr. Hoyle has a type-written copy of his statement before him now.

8923. *Mr. Hoyle.*] It has just arrived, but I have not had time to revise it. If you will permit me however, Mr. President, I will end the matter now, and I do it against the advice of my friends and without any desire to

I now ask permission to withdraw my application to make a statement at all. I will endeavour to get another opportunity of placing it before the public. As a matter of fact the statement is here, but I have not had an opportunity of revising it. I beg now to thank the members of the Commission for the manner in which they have conducted the case. No man could have had more fair play than I have had in this matter. What I have done I did from a sense of public duty; I believed what I did to be right; and I trust that I should do the same though I were faced by any man in the world. Whatever the finding of this Commission may be I shall always consider

and I can only say in conclusion that what I have done I have done from a pure sense of public duty, absolutely free from the promptings of any man. That whatever information I obtained I obtained through documents published in the public press or laid on the table of Parliament House, and from my own experience of fifteen years in the Railway service. I am not a man to be induced to take a step simply because someone comes along and tells me that such-and-such a thing is the case without carefully considering the matter in all its bearings myself. However, the proceedings are now at an end, and all I can say is that again I thank you from the bottom of my heart for the kind and generous treatment that I have received at your hands.

8924. *Mr. Eddy.*] I have also to thank the Commission for the way in which they have conducted the business of the inquiry. I think I can say something very different from what Mr. Hoyle has said in regard to his sense of public duty in the making of statements and charges.

8925. *Mr. Brown.*] I hope you will not say it then.

8926. *Mr. Eddy.*] But I will refrain from doing so, and will only say that I regret that such grave charges should have been made with so little justification, and that the country should have suffered the enormous loss that it has suffered through the Railway Commissioners and their chief officers being withdrawn so much from their duties, the result of which can only be an enormous loss of money and the creation of considerable trouble in the Service; but so far as this Commission is concerned I thank you for the courteous way in which the Commissioners and their officers have been treated.

8927. *President.*] To both Mr. Eddy and Mr. Hoyle it is needless to say that the Commission have done no more than they thought to be perfectly right. They have, I hope, to each side meted out the same measure of justice; and I need hardly say that we are quite charitable enough to attribute good motives to Mr. Hoyle in bringing the charges forward, indeed nobody has supposed anything else. There is no necessity for him, on the one hand, to say that he is not actuated by any evil motive, for we do not consider that he is. On the other hand we shall consider the case apart from any warmth of feeling; and I think it is fair to say this, that if Mr. Eddy has been unduly warm to-day and has offended Mr. Hoyle there cannot be any doubt that he has suffered great provocation, I do not say from Mr. Hoyle, but from others, and that this is only the last straw that is breaking the camel's back, because it may be that Mr. Hoyle has not only brought this matter forward from the best of motives, but he may possibly be quite right in some of his intentions, and, therefore, Mr. Eddy should not have questioned the motives which led him to bring it forward; but at the same time I think great allowance must be made for Mr. Eddy. It is a matter of notoriety that ever since he has been here, by disappointed people, and by people who ought to have known better—there is another Commission sitting and I cannot say more—otherwise I should speak very strongly regarding their actions, but I do not refer to Mr. Hoyle—but in other quarters there has been one of the most disgraceful persecutions I have ever seen in my life. I do not say by whom the persecutions have taken place, because the case is at present *sub judice*. I cannot say more; only let it be understood that Mr. Eddy has been the subject of persecution. I wish to be perfectly understood, that I do think Mr. Hoyle has had any part in them.

FRIDAY, 17 JUNE, 1892.

[The Commission met in the Board-room, Colonial Secretary's Office, at 3 p.m.]

Present:—

F. E. ROGERS, Esq., Q.C., PRESIDENT.

PROFESSOR WARREN, M.I.C.E.,

| ALEXANDER BROWN, Esq., M.L.C., J.P.

8928. *President.*] On the 3rd of this month I received the letter I hold in my hand from Mr. Eddy. It was marked upon the outside "private," but I presume that there is no harm in my referring to it.

8929. *Mr. Smith.*] Certainly not.

8930. *President.*] Because it has since appeared in the public press. The letter is couched in the following terms:—

Sir,

Railway Commissioners' Office, 3 June, 1892.

I write to call your attention to the proceedings at the last meeting of the Railway Commission on the Baldwin engines, and to state that the remarks made by me to Mr. Hoyle were unguarded. But they were made under circumstances of great mental suffering and excitement, cause by the intolerable attacks made during many months past, not only upon my capacity and management, but also upon my integrity and reputation—attacks in which I felt convinced, from a great number

number of circumstances, Mr. Hoyle was involved. Nevertheless, on reflection, I feel I failed in the respect due to the Commission, and also in the respect due to Mr. Hoyle's position before the Commission. I therefore desire to express my regret, and to withdraw the offensive observations I used with reference to Mr. Hoyle and his conduct. If it could be arranged for the objectionable remarks to be omitted from the minutes of the proceedings I should be glad.

I am, &c.,

E. M. G. EDDY.

After that, at a meeting the Commissioners held in this room on the 9th June, which I may state was the first meeting at which I could command the attendance of my colleagues, I caused the following letter to be sent in answer to that of Mr. Eddy:—

Sir,

Colonial Secretary's Office, 9 June, 1892.

Referring to your communication of the 3rd instant, which I regret to say I have not had an opportunity to answer before, in consequence of not having met my brother Commissioners, I desire to say that the Commission accept your withdrawal of the remarks made by you on the occasion referred to, and readily understand that they must have been made under circumstances of great mental suffering. With regard to your request, that "If it could be arranged for the objectionable remarks to be omitted from the minutes of the proceedings" you would be glad, the Commissioners are of opinion that whilst they would be most happy to fall in with your wishes, they think that the application you make should be considered publicly in the presence of all concerned in the inquiry, and with a view to this object being attained, they have convened a meeting of the Commission for the 17th instant, of the time of the holding of which due notice will be given to the parties interested.

I am, &c.,

F. E. ROGERS,

President.

8931. *Mr. Smith.*] I would like to make an explanation here, appearing as I do for Mr. Eddy. Since that letter of the 3rd instant was written, namely, on the 7th of this month, Mr. Eddy has been served with a writ, or rather a writ was issued out of the Supreme Court against him at the suit of Mr. Hoyle in which the endorsement states that the plaintiff claims £10,000 for damages, and so forth. It is a writ issuing out of the Supreme Court of New South Wales, and that writ being in the ordinary form it gave no information as to what the cause of action is, and for reasons which are obvious, it was not preceded by the ordinary solicitor's letter, which gives a general idea of the cause of the action. So that until the declaration is filed, the defendant does not really know what is the cause of action, but Mr. Eddy has, of course, no doubt that it is the outcome of the proceedings referred to in this correspondence, and in connection with which the Commission have met to-day. There are several small matters in connection with this writ which I need not now refer to. I mean in the way in which it was brought to Mr. Eddy's notice at a time when he was in attendance at another Commission, though probably this arose through a mistake. It must not, however, be understood that the reason Mr. Eddy does not appear here to-day is because he is terrified by these proceedings. It is not on account of that he is absent.

8932. *President.*] I do not understand what it is you desire to do, Mr. Smith.

8933. *Mr. Smith.*] I am explaining that in the interval between these two letters a writ was served on Mr. Eddy.

8934. *Mr. Brown.*] I do not think there ought to be any discussion about it in any shape or form. So far as the parties here are concerned, if there is no objection on the part of Mr. Hoyle or anyone else to the withdrawal of these objectionable remarks, the Commission think that course may be taken, but if Mr. Hoyle has any objection to the withdrawal of the report of these proceedings, he can say so, and there is an end to the matter.

8935. *Mr. Williamson.*] I appear for Mr. Hoyle.

8936. *Mr. Brown.*] You cannot appear for Mr. Hoyle. No one can appear here as the representative of any party, it having been resolved by the Commission that counsel should not appear.

8937. *President.*] I understand he appears only with regard to this one particular thing.

8938. *Mr. Williamson.*] Yes; it is only with regard to this one matter. A declaration has been put on record to-day, and Mr. Smith's firm has been served with a copy of it, and I have a copy with me setting forth the grounds of the action. The declaration will show Mr. Smith the full cause of the action.

8939. *Mr. Brown.*] Do you object to the report of the proceedings being withdrawn.

8940. *Mr. Williamson.*] I do; I object to any elimination of the remarks made by Mr. Eddy from the official report.

8941. *President.*] Does Mr. Hoyle object?

8942. *Mr. Williamson.*] Yes; I object on behalf of Mr. Hoyle.

8943. *President.*] I am only speaking for myself, but what struck me was this, that the passages in the proceedings referred to had nothing to do with the evidence in the case, and I proposed to have them eliminated. I refer to what was taken down in shorthand, relating to what was said by Mr. Eddy and also by Mr. Hoyle. I thought it would be better if those remarks should not appear in the printed record of the proceedings. What have they to do with the proceedings in any way whatever, and I understood that this would apply in one case as well as in another.

8944. *Mr. Williamson.*] Our cause of action is based upon what was said by Mr. Eddy.

8945. *President.*] We have nothing to do with your cause of action.

8946. *Mr. Williamson.*] We have been supplied with a type-written copy of the shorthand notes, manifesting that they were part of the records. This [*producing manuscript*] is a copy supplied to Mr. Hoyle.

8947. *President.*] They were not part of the records, then.

8948. *Mr. Williamson.*] It appeared to be so from the copy supplied to me.

8949. *President.*] What appears as part of the record is what is printed in the official report of the proceedings; what you have will not be part of the records until it is printed; and I think it would have been wise for both sides to have it kept out of the proceedings.

8950. *Mr. Williamson.*] The position in which Mr. Hoyle stands is this: A full report of these proceedings was contained in the summary published by the *Sydney Morning Herald*, and has been transmitted to other parts of the world.

8951. *President.*] That is so much damage, of course, but I cannot see how it affects your action in having these passages left out of the records of the Commission. For the sake of both sides I think it would be nicer to have them left out.

8952. *Mr. Williamson.*] If it were the party who was aggrieved—namely, Mr. Hoyle—who made the application, it would be different, and there would be something for the Commission to consider, but for the person who commits the offence to step in afterwards, and ask for these words to be eliminated from the official records, is quite another matter.

8953.

8953. *Mr. Smith.*] I do not ask to have the passages left out; I simply leave the matter to the Commission.

8954. *President.*] Mr. Eddy asks for it in this letter; he says he will be glad if it could be done.

8955. *Mr. Brown.*] If there is any objection to their being taken out of the records they must stand as part of the proceedings, at least, so far as I am concerned. If this objection is pressed I think we must allow them to stand as part of our proceedings.

8956. *President.*] If the matter were left to me I would leave them out. For the sake of both parties I think that would be the better thing to do. There were words, also, which were said on the other side. I do not say they were not very much provoked, but I think, for the sake of both parties, it would have been well to leave these passages out, and if the matter were left to me I would do so; but, of course, it depends upon what the majority of the Commission thinks ought to be done.

8957. *Professor Warren.*] I agree with Mr. Brown.

8958. *President* (after consultation with the other members of the Commission).] The majority of the Commission think that these passages should form part of our proceedings.

8959. *Mr. Smith.*] I beg to say now that inasmuch as proceedings have been brought to the Supreme Court of New South Wales against Mr. Eddy, he feels that he would not be showing sufficient respect to that Court if he continued to appear at the proceedings of this Commission otherwise than as a witness. He thinks he may injure himself by appearing before this Commission in any other capacity, or by taking part in its proceedings in any way other than as a witness. He is quite willing to attend and answer any questions that may be put to him, but his time is now so very much taken up that he thinks it would be more convenient if any information is required from him that the questions should be submitted to him, so that he may be able to furnish the answers required in the form of a return.

8960. *Mr. Brown.*] I do not think we shall want him.

8961. *Mr. Smith.*] Inasmuch as these charges have been brought against the corporation known as the Railway Commissioners, who are now the only party before this Royal Commission, they have furnished me with a retainer under their common seal to appear for them, and if anything should be required on their part I am here to represent them.

8962. *Mr. Brown.*] The inquiry is practically over. It has been reopened only for the benefit of the Commission, to enable them to secure certain information they want.

8963. *Mr. Smith.*] We are anxious to give the Commission all the information we can. So far as we are concerned, I think we will not call any witnesses.

8964. *Mr. Brown.*] We are simply holding this meeting for our own information, and not with the idea of having witnesses from either side.

8965. *President.*] Is Mr. Thow here?

8966. *Professor Warren.*] Before Mr. Thow is examined I would like to say a few words. I asked for a return of the broken rails on the lines where the Baldwin engines were running, showing the number of rails broken since the time they have been running, and also those broken during a similar time previously. That return has not been furnished to the Commission.

8967. *Mr. Smith.*] It will be furnished in due course.

8968. *Professor Warren.*] I hope it will be furnished as soon as possible, as we hope to bring our report out within a week or so.

8969. *Mr. Smith.*] As a matter of fact, there is not a complete record of these rails, but a return is being prepared, and will be furnished as soon as possible. Mr. M'Lachlan left Sydney yesterday to get the figures.

8970. *Mr. Hoyle.*] He did not leave yesterday. I believe I saw him yesterday myself.

8971. *Mr. Smith.*] I have had a telegram from him, despatched from Bathurst this morning.

8972. *Mr. Hoyle.*] He may have gone up by the morning train.

8973. *Mr. Smith.*] Yes, probably. Any particulars the Commission want relating to this matter will be furnished as soon as possible by the Railway Commissioners.

8974. *President.*] There is some difficulty about this matter, Mr. Smith. Hitherto we have not had either the Railway Commissioners or Mr. Hoyle, represented by counsel or solicitor, and one at all events of my fellow Commissioners, thinks it undesirable to admit counsel or solicitor to represent either party at this late stage of the proceedings.

8975. *Mr. Smith.*] I do not take any part in the proceedings in that way. The Railway Commissioners do not appear, and I am here simply as their representative. They are a corporate body represented by their common seal, and as they cannot very well bring their common seal here to represent them. I have been retained to appear on their behalf.

8976. *President.*] Mr. Eddy was here at the early stages of the inquiry, and in the later Mr. Fehon appeared.

8977. *Mr. Smith.*] And Mr. Eddy also appeared in the later stages. His sole reason for not appearing now is that an action has been brought against him.

8978. *Mr. Brown.*] If he likes to stay away, that is his own look out; but so far as we are concerned, we do not intend to have any of the parties represented here by counsel.

8979. *Mr. Smith.*] Quite so. I am not going to have any counsel here.

8980. *Professor Warren.*] You will write about the return I spoke of, Mr. Smith?

8981. *Mr. Smith.*] I undertake to furnish the return.

8982. *Professor Warren.*] I am surprised that it should take more than an hour or so to furnish the particulars. We know these things are kept on record by all railway companies.

William Thow recalled:—

8983. *President.*] Mr. Thow, we want you to give us all the information you can about the breaking of a tire of one of the wheels of a Baldwin engine, which took place last Monday week between, I think, Bowenfels and the next station. Do you remember the breaking of that tire? Yes; I remember the case.

8984. Do you know anything yourself about it? I have seen the broken tire.

8985. Can you give us any reason for its breaking? I do not think I could just now. The steel has not yet been tested. The tire was made of steel by a very good firm in America, and it broke apparently without

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without any extra strain. There was no unusual work on the tire at the time it fractured, but the testing of the steel is the only thing that will reveal the cause of its breaking. To all appearance the material of the tire is very good steel, but I should say it was hard?

8986. *Hard?* Yes; hard; and that would cause the fracture. If it is over-hard it is unsuitable, because a tire must have a certain amount of elasticity, and you cannot have both hardness and elasticity.
8987. Would you call it good steel for a tire? I would rather not speak upon that point until the material has passed through the tensile test, because any opinion I now give is simply drawn from the appearance of the tire. We are preparing to test pieces of the tire, and they will be ready on Monday night or Tuesday, and the result of those tests will show what the steel is.

8988. When will you have the tests completed, that is to say, when will they be in such a condition that anyone could give us information about the tire? Wednesday or Thursday next, I should think.

8989. *Professor Warren.*] Might I ask who is going to test the pieces? I think it is very likely it will sent to the University.

8990. In any case I would like to know the nature of the tests, because one would then be able to form an opinion on the quality of the steel from the nature of the tests you are going to submit it to.

8991. *Mr. Brown.*] Was it the tire of the bogie-wheel or of the tender-wheel? It was on one of the tender-wheels.

8992. Is it usual for a tire to break in that way? I have known them to break; but it is not a very usual thing for tires to break in that way.

8993. *President.*] Was there anything the matter with the bolts? No; they were all right. They came off after the tire itself broke. That seemed to be proved by the examination that was made.

8994. So that there was nothing the matter with the bolts? Nothing at all.

8995. *Professor Warren.*] You think the breakage was entirely due to the steel of the tire? I think so, from the appearance of the steel. When we cut it, I saw it was very hard—probably too hard to be good material for a tire.

8996. *Professor Warren.*] We have had evidence of another tire breaking. Mr. Park gave some evidence on the subject? Yes, there was one that broke.

8997. *President.*] What tire was that? A tender-wheel tire.

8998. *Professor Warren.*] The present one is a tender-wheel tire also, is it not? Yes.

8999. *Mr. Brown.*] You do not know the circumstances under which it broke, do you; was it a passenger Baldwin engine? Yes; the tire of the wheel which broke at Bowenfels was on a Baldwin passenger engine. We have had three tires broken altogether. Two have been on passenger trains, and one on a goods train.

9000. *President.*] Was the one Professor Warren referred to on a passenger or a goods train? The first one was on a goods train, and the other on a passenger train.

9001. *Mr. R. Smith.*] I have a report by Mr. Thow, which gives details of these matters.

9001½. *Mr. Brown.*] How many of the Manchester engines have you—the large ones? We have twelve running, and I think eight in the harbour.

9002. How long have these been running? I suppose they have been running about seven weeks.

9003. Have they shown any defects in the wheels or tires? No; nothing at all.

9004. *Professor Warren.*] Do you not think it unusual for so many tires to have broken since these engines—I refer to the Baldwin engines, of course—have been here? It is unusual.

9005. And there is no guarantee that the other tires are any better?

9006. *Mr. Smith.*] I am authorised to say that on this tire breaking the Railway Commissioners took the opportunity of ordering that the whole of the tires, forty-eight in number, should be taken off, and other wheels and axles should be placed upon the Baldwin engines. They were withdrawn from traffic until this was done, and they are not being put into traffic where the ordinary standard tires still remain. In order to afford an opportunity to this Commission to examine the tires it was suggested that they should inspect all of them, and then select from the whole one, two, or three which they thought might look the worst and submit them to any strains or tensile tests thought fit. Of course, the Railway Commissioners are just as anxious as this Royal Commission to secure the safety of human life, and they felt that it was a very unusual circumstance that after an engine had travelled only 20,000 miles, a tire should break. They thought there was something extraordinary in this happening. This is not a matter which originally arose upon inquiry before this Commission; but since this accident has happened the Commissioners desire me to say that they have taken them off and put new wheels and axles in place of the old ones, and the whole of these old wheels and axles have been kept, so that it would be convenient, in the event of the Commission appointing experts to test the wheels. Professor Warren himself, who is a member of this Commission, might undertake the necessary tests. Of course, the broken tires will be examined by direction of the Railway Commissioners, and if they are not examined by Professor Warren himself, he will be asked to be present at the examination. Of course, in saying this I have presumed that the Commission defer to Professor Warren as their scientific representative.

9007. *President.*] Of course.

9008. *Professor Warren.*] I may state that the best examination will be in the testing machine, where we can obtain ductility and tensile results. The only machine available for such a purpose is at the University, so that if I could get the test pieces which have been already prepared we could settle the question beyond all doubt.

9009. *Mr. Smith.*] Hitherto the Baldwin Engine Company have not made any objection to refunding in cases where defective material has been proved to have been used. The Railway Commissioners have money in hand not yet paid to the Baldwin Company, and it is proposed to charge that company with the expense of refitting these engines. If it were considered advisable to break up five or six more of these wheels it might be done.

9010. *Mr. Thow.*] The following is the report I made with regard to the breakage of tires:—

The first case of broken tires on Baldwin engines occurred on the tender of engine No. 485 (goods), which engine worked No. 46A up-goods into Penrith on the 4th May. After the arrival in locomotive yard at that station it was found that the left hand leading tender tire was broken. The wheels were changed, and no damage and no delay to traffic was caused by this breakage. The next case was that of engine No. 443 (passenger), on which the tender tire broke when working No. 28 up-passenger train on the 6th instant, from Bathurst to Penrith. Driver Fullerton reports that when approaching mileage 98'50 chains, between Wallerawang and Bowenfels, at about 11'50 a.m., his fireman (H. Smith) called out to him, "Hold hard." Fullerton at once stopped the train as quickly as possible, and upon looking round he found the tender and

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a horse-box, which was the leading vehicle on the train, oscillating very much. Upon getting down, he found the tire of the third pair of tender wheels on the right-hand side was broken and off the wheel, causing derailment of the trailing bogie of the tender and the leading wheels of the horse-box. Delay was occasioned to the two passenger trains by this accident. The only damage to permanent-way was a few chairs broken. The damage to the rolling-stock consisted of the trailing tender bogie frame being broken and some of the air pipes broken. The time-table speed for No. 28 up-passenger between Wallerawang and Bowenfels is 31 miles an hour. The next case occurred about midnight last Sunday, the 12th instant, when engine No. 449 (passenger), after having worked the up-mail train from Dubbo to Bathurst, was, upon examination by the driver, Beverley, after reaching the shed, found to have the third tender tire on the right-hand side broken. This tire had not left the wheel, and had only just broken, as the tire bolts were found lying close by. There have been two cases of stoppage of Baldwin engines in Bathurst, which may wrongly have been attributed to breakage of tires. Their defects were as follows:—One instance is that of engine 452, which was booked up to work the up-mail from Bathurst on the 7th instant, but during the day it was found that one of the tender wheels was loose on the axle. Nothing was wrong with the tire. This, however, rendered it necessary that the engine should be stopped, and another engine sent with the mail. The other instance is that of engine 450, which was discovered last week to have one tender wheel loose on the axle, and therefore could not be sent with the train until the wheels were changed.

9011. *President.*] I might mention to you that at a meeting we held last night, this very point was considered. Of course we were not in a position then to dictate to the Commissioners what should be done, but we were I think pretty well agreed that it would be a wise step if the engines were to some extent withdrawn from service until they had been thoroughly tested.

9012. *Mr. Brown.*] We came to the conclusion that you should remove the wheels and axles, and submit them to a proper test before you allowed them to run again. That was part of the Commissioners' decision last night, and it will be a part of their recommendations.

9013. *Mr. Smith.*] There is another little matter. Mr. Thow has stated that the tires were made by a good manufacturer. The specifications says that they were to be made by the Standard Company of America, and I understand that a tire made by the Standard Company means a tire made up to their test, which is a very severe one. A Standard Company's tire means not merely a tire made by the Standard Company, but a tire that has been submitted to a certain test provided by the company, just as Vicar's steel, or Otis steel, or B.P.B. steel means steel of a guaranteed quality.

9014. *Mr. Hoyle.*] I understand from what Mr. Smith says, that it is intended to put on new axles and wheels. I also understand that it is the English type of wheel and axle that is going to be placed in the engines when these have been removed and that these wheels and axles are not going on again.

9015. *Mr. Smith.*] Not until they have been tested. Those not broken will probably be sent back to America. If they are found to be unsatisfactory, the Railway Commissioners will return them to the Baldwin Company. Hitherto the Baldwin Company have never made the slightest objection to making good any loss that has occurred through an error on their part, and I might say that there are ninety-one locomotives in the Tramway Department all made by them, and that not a single one of the tires (and all of them were made by the Standard Company) have shown the slightest indication of giving way. I think I am right, Mr. Thow? Yes.

9016. *Mr. Smith.*] Further than that, none of the old Consolidation engines which have been in use for so many years have given any trouble by reason of defective workmanship or material in the tires.

9017. *Mr. Hoyle.*] One broke.

9018. *Mr. Smith.*] Well, I did not know that even one of them had broken. And what I want to point out is this, that it seems very strange as the tires had given such satisfaction in the past, in connection with the tramway motors, and the old Consolidation engines, they should have given trouble when manufactured for a more highly-finished machine.

9019. *Mr. Brown.*] I would just like to read to you one paragraph from the report—a paragraph upon which the Commission decided last night: "The Commission further recommends, inasmuch as certain of the axles and wheels have not yet been submitted to any test, that in the interests of the travelling public steps should be taken immediately to have a thorough examination made by the drop and hydraulic tests of the axles and wheels which have not yet been tested, and in the meantime all the Baldwin engines be withdrawn from passenger traffic and that they be employed upon goods traffic for a reasonable period, until it has been demonstrated, as far as it can be conclusively, that there is no liability of further accident by the breakage of the axles or the loosening of the tires." It is somewhat singular that the Commission should have come to that conclusion last night, in the face of the announcement that you have made to-day with regard to the intention of the Railway Commissioners.

9020. *Mr. Smith.*] Yes; I should like to explain that inasmuch as the engines were required to keep time, and to avert the inconvenience of much delay in the traffic, they were not taken off the line, but were merely fitted with other wheels and axles, and have now nearly all been restored to service. I believe that is right, Mr. Thow?

9021. *Mr. Thow.*] Yes; they are being replaced. I should like to explain. The last breakage of a tire occurred on the 12th instant. Immediately after that—on the 13th instant—a meeting was held between the Commissioners, and one or two of their officers, including myself, and it was at that meeting decided that in order to give the public a feeling of security, the whole of the tires under the tenders should be withdrawn from passenger traffic, and as soon as possible they should be replaced by tires which we had greater confidence in. As soon as those tires have been changed, or I should say as soon as the wheels and tires have been changed, and English made tires and wheels put under the tenders of the Baldwin engines, then the engines will be returned to traffic. At present they are not doing any work whatever, but they will be returned, and we shall make the change as quickly as possible, probably at the end of next week, or very soon afterwards. The whole of the passenger engines, and one or two of the Consolidation engines—certainly one of them—will then have had the whole of their tires changed, and they will consequently be employed in the running of trains again, whether upon goods or passenger trains I am not at present in a position to say.

9022. *President.*] But have any of the tires of the engine wheels given away? I do not know that any of the engine tires have broken; I have not heard of any breaking. One wheel came off—got loose on the axle—but that is the only defect that I am aware of in connection with the engine wheels.

9023. *Professor Warren.*] You have then a great many of the tires taken off these engines and lying at Redfern? No; we are taking off the original tire, wheels, and axles, and putting in new tires, new wheels, and new axles, so that we have not taken the tires off the wheels.

9024. No; there are twenty Consolidation and twelve passenger engines, that is thirty-two engines altogether, and there are ten wheels under each engine. I want to get at the number of tires? You have eight tires under each tender and ten tires under each engine—eighteen under each machine.

9025. Then there are 576 tires altogether to be considered? Yes.

9026.

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9026. I think the usual practice is to take one in fifty for the purposes of testing, but one in 100 would be sufficient for all practical purposes? One per cent. is the usual thing.
9027. That would practically be six tires then. Do you think that would be too many to test? I think you would be in a better position after you have tested the tire that is broken. That is the way that I would go about it.
9028. And those will be ready by Tuesday? Yes; I think so.
9029. What would you consider to be the tensile strength and the elongation and contraction of area that tire steel ought to stand? Well, perhaps I had better hand in my own specification for tires. This gives the drop test and the tensile strength:—"The tire selected for test is to be placed in a vertical position without being annealed, reheated, or otherwise manipulated for test purposes, on a solid, metal foundation of at least 10 tons, and subjected to repeated blows from a 1-ton tup falling from a height of 10, 15, 20, and 25 feet or upwards, and it must be flattened at least one-sixth of its diameter without showing any signs of fracture."
9030. *Mr. Smith.*] What do you put the tensile strain at? Forty-five to 52 tons.
9031. *Professor Warren* (to *Mr. Smith*).] Will you supply me with the tests of the Standard Company. It will be interesting to have a specification of the test to which the Standard Company subject their tires?
9032. *President.*] *Mr. Thow* tells us now, that the tires about which there is any doubt are not running, and will not be running again until they are tested?
9033. *Witness.*] There are a few running on goods trains, but not on passenger trains.
9034. *President.*] But the same danger does not exist in the case of goods trains? No; I do not think there need be any anxiety whatever about the tires when the engines are employed in goods traffic, because it is very unusual for that kind of accident to happen. The tire that broke so recently had become so loose on the wheels that it was pushed by the pressure of the rail inwards towards the axle. The flange of the tire was gradually pushed off the wheel on to the axle, and became a loose ring there.
9035. *Professor Warren.*] How many wheels do you know of that have worked loose on their axles? I cannot give you the exact number, but I should fancy a dozen or fifteen.
9036. As many as that; but what you are going to do with the tires will not affect that question? We are going to put under the engines new axles, new wheels, and new tires.
9037. *President.*] In point of fact, the whole undercarriage, if one might use that word in connection with locomotives, is to be new? Only so far as the wheels, tires, and axles are concerned. The carriage proper is available, and new wheels will be fitted to it.
9038. *Professor Warren.*] I do not think there is any necessity to ask *Mr. Thow* further questions. Will you let me have the test pieces as quickly as possible, *Mr. Thow*? Yes.
9039. *Mr. Brown* (to *Mr. Hoyle*).] I do not know that it will be necessary for you to ask any questions as this evidence has been called by the Commission purely for their own information.
9040. *Mr. Hoyle.*] Very well. I do not think there is anything that I want to ask questions about from *Mr. Thow*.
9041. *Mr. Smith* (to *Witness*).] Why were you not able to get all the test pieces ready before this, *Mr. Thow*. Perhaps it would be as well for you, merely as a matter of explanation, to tell the Commission? On account of the steel being so hard. We have been working upon this particular tire, endeavouring to get the test pieces prepared, for the last three or four days, but the steel is so hard that the machines will not make any progress with it.
9042. *Mr. Smith.*] Thank you. I merely wanted to get the reason for the delay on record.
9043. *President.*] If you want to ask any questions, *Mr. Hoyle*, you had certainly better do so, because something may come out as the result of your examination of the witness that has not transpired from any questions that have been asked by us.
9044. *Mr. Hoyle.*] Well, I might just ask whether the tires on the tramway motors are not of English steel? Yes. I think they are made by Vickers.
9045. The tires of the tramway motors are of English make—Vickers, I believe? Yes; I believe they are.
9046. There was a tire broken at Bathurst since the one you referred to broke at Narrangaroo? Yes; that would be the one that I referred to as happening on the 12th.
9047. Did it come off or did it break? It broke in the yard after the engine came in with its train, because after the tire was broken the bolts holding the tire were found by the broken pieces. It was evidently broken by being subjected to too great a tension. Of course, when a tire is running it gets hot, and when it stops it contracts, and I have no doubt that that tire broke as the result of contraction consequent upon cooling, showing also that the material was exceedingly hard. I subjected one to a test this morning. On that occasion I took the tire off the opposite wheel to that which broke at Bowenfels, and tried it under the drop-test. It stood two blows, one of a ton at any rate falling 6 feet, and the other a ton weight falling 10 feet, and it broke under the 10-foot blow.
9048. *Mr. Brown.*] And what ought it stand? It ought not to break at all. It ought to bend, not break. Our test requires such tires as we are dealing with to be bent one-sixth of their original diameter, so that if a tire is 24 inches in diameter it would have to bend 4 inches before it was passed as a good tire. The first blow of 6 feet bent this tire a quarter of an inch, which was a very small amount indeed, and the second blow broke it. From appearances, I should say that it broke simply because it was very hard steel. I do not say that the steel was bad quality steel, but it was very hard steel.
9049. *President.*] It would not be good steel for tires? No; certainly not. You must have a certain elasticity and a certain softness in the tire. The test that we specify is as follows:—"The tire selected for test is to be placed in a vertical position, without being annealed, reheated, or otherwise manipulated for test purposes on a solid metal foundation of at least 10 tons, and subjected to repeated blows from a 1-ton tup, falling from a height of 10, 15, 20, and 25 feet, or upwards, and it must be flattened at least one-sixth of its diameter without showing any sign of fracture."
9050. *Mr. Smith.*] There are two other witnesses, but I do not think they can give any evidence upon this matter. They are the driver of the engine No. 448, which broke the tire, and the locomotive foreman of the district, but they cannot, for the purpose of this inquiry, give any evidence at all of value. The principal thing is to test the tires, and no evidence that persons who have merely looked at it could give would be of any use whatever, would it, *Professor Warren*?
9051. *Professor Warren.*] Not the slightest.

9052. *Mr. Smith.*] The only evidence worth having now is the evidence as to how it worked. That shows that it was hard, and the evidence that Mr. Thow has given also shows that it is hard, because it broke with a blow of 1 ton falling 10 feet, and the evidence you require in addition to that is the result of the test.

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9053. *Mr. Brown.*] The action of the Railway Commissioners in having taken the wheels, tires, and axles off the engines used in the passenger traffic has changed the aspect of the whole thing. As far as I am concerned, I do not want to ask any more questions.

9054. *Mr. Smith.*] Professor Warren has referred to the return of broken rails for which he asked. I wish to explain how it is he has not received that return before. The practice is to remove from the line all crippled rails, and to keep a return of them, but not to specify how many of them were actually broken. As a matter of fact, I had occasion to look up the returns in the case of the late Tarana accident, and I found them utterly valueless for my purpose, because they included all the crippled rails,

9055. *Professor Warren.*] Now I quite understand what you mean, Mr. Smith.

9056. *Mr. Smith.*] The returns will not be very useful to you even when complete, because the rails are constantly getting older, and are being replaced by other rails. A return of the kind you ask for dealing with the later rails would be reliable, but not returns as old as two years ago. I do not know whether the Commission has seen Mr. Price Williams' report.

9057. *Mr. Hoyle.*] Yes. It has been put in evidence.

9058. *Mr. Smith.*] Mr. Price Williams, in his report, dealt with the very subject, speaking of the Goulburn line, and another important matter was this, that after the reballasting and boxing up of the line, necessarily there was a large number of crippled rails to take out.

9059. *Professor Warren.*] Yes; I see that. The crippled rails would then be brought to light.

9060. *Mr. Smith.*] At all events, the information the Commissioners ask for will be furnished.

9061. *Professor Warren.*] If I have to give evidence on the test, and can get the test pieces on Tuesday, I shall be able to run over them by Wednesday.

9062. *Mr. Smith.*] What about the Glenlee bridge?

9063. *Professor Warren.*] I have written the report, and intend to put it in evidence, and I thought of treating the axles in the same way.

9064. *Mr. Smith.*] I suppose the report on the Glenlee Bridge is not ready yet?

9065. *Professor Warren.*] Yes; it is ready, but that is all. I do not know whether I can disclose it.

9066. *Mr. Smith.*] I dare say that I shall be able to let the Secretary have the other particulars on Monday.

APPENDIX.

CORRESPONDENCE *re* Purchase of Baldwin Engines.

Twelve 10-Wheeled Passenger Engines, 1890.

IN consequence of the period of time that would elapse before delivery could be given of engines ordered from England, the Commissioners, after consultations with their officers, found it absolutely necessary that immediate steps should be taken to secure engine power to prevent the traffic in the wool season of 1890-1891 from being seriously hampered. Information being to hand that in the United States, where the conditions in many respects resemble the conditions on our lines, a new departure in engines has been tried with most satisfactory results, the Commissioners decided to instruct Mr. D. H. Neale (Mechanical Engineer), Messrs. Loughry and Stanger (our Out-Door Locomotive Superintendents), and Mr. Howe (workshops manager), to report in the matter of the merits of the 10-wheeled American Express engines and 8-wheel consolidated good engines.

Their report and other correspondence, &c., in connection with the ordering of the Baldwin engines, are appended.

PURCHASE of American Passenger Engines—Joint Report of Messrs. Loughry, Stanger, Howe, and Neale. To the Railway Commissioners,—

Gentlemen,

1 September, 1890.

After carefully considering this question as requested, and in view of the urgent necessity for more locomotives, we are unanimously of the opinion that it would be advisable to purchase not less than twelve powerful American passenger engines, provided that the builders can guarantee early delivery.

The Rogers engine for the Chesapeake and Ohio (as illustrated in the *Railroad Journal* for July, 1890) and the Baldwin Engine for the Baltimore and Ohio (described in the *Railroad Gazette*, 13 June, 1890), both appear suitable and sufficiently powerful for our requirements, viz., hauling a train of four express carriages fully loaded, and two 28-ton sleeping cars up 1 in 40 at 25 miles per hour, and capable of attaining an average speed (including stoppages) of 32 miles per hour between, say, Goulburn and Junee, where there are constant undulating gradients of 1 in 40.

The engines require, however, the following modifications:—

Our coal being good the grate area might be somewhat reduced, lessening the weight on each driving axle to not exceed $14\frac{1}{2}$ gross tons or 32,500 lb.

Our water being bad, the fire box should be copper and the tubes brass.

No bell is required.

Hand-brakes and Westinghouse automatic are wanted on all driving and on all tender wheels.

Screw reversing gear is wanted.

Trailing sand-pipes behind rear driving-wheels are wanted.

The sand-boxes would be preferred on or under the footplate instead of on top of boiler.

Bushes are preferred on coupling-rods.

The connecting-rod would be preferred with adjusting cotters and split brasses as usual, but without straps.

The capacity of the tender should not be less than 3,600 American gallons.

The gauge of road is 4 ft. 8½ in.

The extreme height of chimney should not exceed 13 ft. 6 in.

The extreme width of engine should not exceed 9 ft. 6 in., and if possible should not exceed 9 ft. 3 in.

Particular care should be taken that all bearings of importance should have good oil-cups or cellars, capable of holding a proper worsted syphon or other efficient means of feeding oil. All oil-cups should have proper covers, well secured, and dust proof, as our line is very dusty, and hot bearings very common.

The workmanship throughout should be extra good, especially in boiler-work and in the smith-work of rods and frames.

The engine and tender should be fitted with the European style of cover buffers and draw-hook.

The latter should stand a breaking-strain of not less than 100,000 lb. The pilot or cow-catcher should be arranged to suit the use of these buffers.

An ample supply of spare parts should be included, so that delay may be avoided in replacing parts damaged by accident.

It is presumed that these engines referred to, being for American trunk lines, and used in hauling their most important trains over the most trying parts of their systems, that the details of the engines (not before us) are in every respect first-class, and representative of the best American practice. That being the case, it would be safe to adhere to the other details of the engine as made for the American railways.

Both Baldwin and Rogers are excellent makers. The former firm have made many of our present engines, and therefore know many of our requirements, their travelling partner, Dr. Williams, having lived here for some time. The latter firm also do an export business, and are thought by some to turn out better finished work.

These engines would be especially useful between Penrith and Bathurst and between Picton and Junee, and might also be used on Northern Line on the long inclines between Tamworth and Armidale.

They would save a great deal of assisting mileage, and twelve such engines would virtually do the work of over twenty of the best of our present passenger engines.

We, remain, &c.,

H. D. NEALE,
(For H. HOWE),
E. A. LOUGHRY,
G. H. STANGER,
and Self.

Sirs,

New South Wales Government Railways,
Secretary's Office, Sydney, 2 September, 1890.

Sirs,

The Commissioners would be glad if you would quote a price for twelve engines, delivered in steam in Sydney, exactly similar to those constructed by the Baldwin Locomotive Works for the Baltimore and Ohio Railroad Company, and described in the *Railroad Gazette* of 13th June, 1890, with the following modifications:—

Our coal being good, the grate area might be somewhat reduced, lessening the weight on each driving-axle to not exceed $14\frac{1}{2}$ gross tons, or 32,500 lb.

Our water being bad, the fire-box should be copper and the tubes brass.

No bell is required.

Hand-brakes and Westinghouse automatic are wanted on all driving and on all tender-wheels.

Screw reversing gear is wanted.

Trailing sand-pipes behind rear driving-wheels are wanted.

The sand-boxes would be preferred on or under foot-plate instead of on top of boiler.

Bushes are preferred on coupling-rods. The connecting-rod would be preferred with adjusting cotters and split brasses as usual, but without straps.

The capacity of the tender should not be less than 3,600 American gallons.

The gauge of road is 4 feet $8\frac{1}{2}$ inches.

The extreme height of chimney should not exceed 13 feet 6 inches.

The extreme width of engine should not exceed 9 feet 6 inches, and if possible should not exceed 9 feet 3 inches.

Particular care should be taken that all bearings of importance should have good oil-cups or cellars, capable of holding proper worsted syphon or other efficient means of feeding oil. All oil-cups should have proper covers, well secured and dustproof, as our line is very dusty and hot bearings very common.

The workmanship throughout should be extra good, especially in boiler-work and in the smith-work of rods and frames.

The engine and tender should be fitted with the European style of corner buffers and draw-hook. The latter should stand a breaking strain of not less than 100,000 lb. The pilot or cow-catcher should be arranged to suit the use of these buffers.

An ample supply of spare parts should be included, so that delay may be avoided in replacing parts damaged by accident.

The Commissioners would, of course, allow you any shop facilities for erecting the engines, but would require you to send out a man to erect them and put them in steam. Early delivery is very essential, and will be an important factor in placing the order.

I have, &c.,

H. McLACHLAN,

Secretary.

Messrs. Towns & Co., Sydney.

There is some little doubt whether we can allow you anything beyond 9 feet 3 inches for the extreme width of the engines, but the matter is being inquired into, and you could cable your principals definitely on this point before the letter could reach them. It would be well if you arranged a code on this point and enclosed it in the letter.

The Commissioner for Railways, Sydney,—

Gentlemen,

Sydney, 8 September, 1890.

Immediately after our Mr. Stokes' interview, of 2nd instant, with Mr. Eddy, we forwarded following cable to the Baldwin Company:—

"Reply by wire quickly price and earliest date delivery approximately, in steam, at Redfern, twelve passengers, similar to Baltimore and Ohio ten-wheeled express, copper fire boxes, despatch urgent."

And have just received following reply:—

"\$15,000 each, including steel boiler, copper fire-boxes, iron tubes, wheel, hand-brake on tender, Westinghouse automatic on drivers and tender, tender and truck wheels with steel tyres, buffers, English, free on board steamer, Redfern extra. If screw reversing gear, \$75; copper stay bolts, \$540; brass tubes, \$1,650; shipment five months."

From this you will see that the offer is free on board steamer. The time mentioned "five months" will, we hope, be within your idea of despatch.

I have, &c.,

R. TOWNS & CO.

New South Wales Government Railways,

Secretary's Office, Sydney, 9 September, 1890.

Gentlemen,

Referring to your letter of yesterday's date, I am directed to say that the Railway Commissioners are disposed to consider favourably Messrs. Baldwin's offer to supply twelve 10-wheeled express passenger engines as contained in your letter, but I have to call your attention to the fact that in my letter of the 2nd instant, I asked that the engines might be modified and reduced in weight by lessening the grate area. This would decrease the cost somewhat, and the Commissioners presume that it would be allowed for by the Baldwin Company. I have also to call your attention to the extreme width of the engine. This is a very important point, and it is thought that the width of the engine could be kept down to the figure given without making any serious alteration. The offer of the Baldwin Company does not include a hand-brake on the engine, but I presume there would be no difficulty about this. The Commissioners would like to understand whether the price quoted includes the services of a man from the Baldwin Company to superintend the erection.

I presume you have forwarded a copy of my letter, of the 2nd instant, to the Baldwin Company, but should be glad to hear definitely from you upon this point, and on the other points raised in this letter, before the Commissioners decide definitely upon giving the order.

I need hardly remind you that early delivery is of extreme importance, and that this order, if given, will be a trial one based on the understanding that the engines will perform the heavy work needed on our very severe gradients, and can be delivered f. o. b., New York, early in February, and be in steam here in April, 1891.

The Commissioners would be glad if you could also quote an inclusive price, delivered in steam here, and subject to the conditions in my letter of the 2nd instant.

I have, &c.,

H. McLACHLAN,

Secretary.

Messrs. R. Towns & Co., Sydney.

The

The Commissioners for Railways, &c., Sydney,—
Gentlemen,

Sydney, 9 September, 1890.

We have the honor to acknowledge the receipt of your favour of this date, and have despatched following cable to Baldwin Company:—

"Reduce weight to 32,500 lb. per axle by reducing grate area, allowance expected for reduced weight. Screw hand-brake on tender and drivers, Westinghouse air on drivers and tender. Width over all, 9 feet 3 inches. Offer includes an engineer. Must supervise erection and trial. Commissioners desire alternative offer to deliver on shore at destination of vessel. Must have immediate reply."

We shall communicate with you immediately reply is received.

We have, &c.,
R. TOWNS & CO.

The Commissioners for Railways, Sydney,—
Gentlemen,

Sydney, 11th September, 1890.

The following cable has reached us from the Baldwin Locomotive Co.:—

"Are working freight, wait advices."

The Company is endeavouring to secure the best terms for freight in the Locos., and it is very probable that in the course of the day we may receive a cable giving full particulars.

We remain, &c.,
R. TOWNS & CO.

The Commissioners for Railways, &c., Sydney,—

Dear Sirs,

Sydney, 16 September, 1890.

We have just received following cable from the Baldwin Company in reply to ours, of which you have copy:—

"Price will be 13,500 dollars, f.o.b., New York, in February. Screw hand-brake on tender and drivers. Westinghouse air on tender and drivers. An engineer must supervise erection trial. Expecting figures steamer delivery."

You will see that they have met your wishes as to modification in price.

We shall no doubt receive the alternative offer in a few days.

Yours, &c.,
R. TOWNS & CO.

Accept.—E.M.G.E., C.O., 17/9/90.

Re Locomotives.

The Commissioners for Railways, Sydney,—

Dear Sirs,

Sydney, 20 September, 1890.

As requested by Mr. Neale, we yesterday cabled the Baldwin Company as follows:—

"Commissioners will accept. Proceed with work as per telegram. Letter will give further detail. Waiting alternative offer,"

and have just received following reply:—

"Order entered for twelve, try to increase order to eighteen or twenty, full steamer load. Contract to deliver f.o.b. at destination of vessel (*i.e.* Sydney), \$14,800; contract to deliver on shore at Sydney, \$15,000."

This cable is, we think, sufficiently explicit. We shall be glad to wait upon you if desired.

Yours, &c.,
R. TOWNS & CO.

Government Railways of New South Wales,

Gentlemen,

Secretary's Office, Sydney, 22 September, 1890.

I am directed by the Railway Commissioners to inform you that they accept the offer of the Baldwin locomotive works, to supply twelve 10-wheeled express engines and tenders similar to those recently supplied to the Baltimore and Ohio Railway under a guarantee to haul a passenger train of seven cars up a grade of 116 feet per mile, and 17 miles long at a speed of 25 miles per hour.

The price of these engines modified as under to be \$15,000 landed at wharf, Sydney, April, 1891, copper fire-boxes, screw hand brakes on both engine and tender, Westinghouse automatic on engine-drivers and on all tender wheels. Grate area to be reduced so that weight on each driving axle is about 32,500 lb. The Baldwin Company to send out a competent engineer to supervise the erection of these engines, but the Commissioners will supply labour, and shop, and crane accommodation.

All wheels, engine, and tender, to have steel-tires, boiler to be of steel, no bell is required.

Trailing, sand-boxes, and pipes behind rear drivers are wanted.

All sand-boxes on or under foot-plate instead of on top of boiler.

English style buffers, and draw-hook on front of engine and back of tender.

Bushes on coupling-rods. Connecting rod would be preferred with split brasses and cotters as usual, but without straps. The capacity of the tender should not be less than 3,600 American gallons.

A tender interchangeable with those supplied in 1885 for passenger Mogul engines preferred.

The gauge of road is 4 feet 8½ inches.

The extreme height of chimney from rails should not exceed 13 feet 6 inches.

The extreme width of engine should not exceed 9 feet 3 inches.

Particular care should be taken that all bearings of importance should have good oil-cups or cellars capable of holding proper worsted syphon or other efficient means of feeding oil. All oil-cups should have proper covers, well secured, and dust-proof, as our line is very dusty, and hot bearings very common.

The workmanship throughout should be extra good, especially in boiler-work, and in the smith-work of rods and frames.

An ample supply of spare parts should be included, so that delay may be avoided in replacing parts damaged by accident. A list of these parts will be forwarded to the Baldwin works by an early mail, for which a C.I.F. quotation is requested by cable.

The

The prices quoted for the following extras are agreed to :—Copper fire-box stays, 540 dollars ; screw reversing-gear, 75 dollars ; brass tubes, 1,650 dollars.

The Commissioners will forward by next mail blue prints of the following parts as a guide to the Baldwin works :—(1) drawhook ; (2) Turton buffer ; (3) cylinder flange ; (4) connecting rod-end ; (5) contour of tire.

The Baldwin works are requested to work exactly to the dimensions of the first and second blue prints. The third is intended as a means of flattening the cylinder-flange, so as to keep the engine within the limits of width without narrowing the centres of the cylinders, and, therefore, shortening the crank-pins.

The Baldwin works are, however, at liberty to obtain the same end by any other means they consider preferable.

The connecting rod end shows a form that works well here, and one of similar design would be preferred to the strap end usual in the United States. The blue print shows an end for an engine with 18 in. cylinders and 150 lb. boiler pressure, and the dimensions would require modification for the larger cylinders, and higher pressure of the present engine.

The contour of the tire should be worked to exactly for all tires with flanges.

The sharpest curve on our road is 528 feet radius (nearly 11 degrees). The steepest grade is 176 feet per mile.

It is proposed to haul with this engine trains weighing 152 gross tons (340,500 lb.) up long grades of 130 feet per mile. This would be the usual train, and we expect it to be hauled up this grade at about 22 miles per hour. Occasionally the train would have an additional car, making the load without engine and tender 176 tons or 394,240 lb. These loads include a full complement of passengers, mail, and baggage. The cars are all on trucks or bogies.

The regular load up the 176-foot grades would be 120 gross tons (269,000 lb.) without engine or tender. These grades are free from very sharp curves, and, therefore, in practice a greater proportionate load can be hauled than on the 130 foot grades. It is therefore expected that occasionally an extra car could be hauled, making the total weight of the train 144 gross tons (322,500 lb.) without engine or tender.

The Commissioners would be glad to have your guarantee that your engines can perform this work.

The engines should have brick arches in fire-box.

American headlights and pilots or cow-catchers have not been hitherto used on our lines, but the trial of the latter is contemplated, and therefore we should be glad to have iron-pilot or cow-catchers on the engine you furnish, but headlights will not be required.

The Commissions regret that their urgent need of these engines prevents a further examination of their design, but trust the Baldwin works will do their best to supply thoroughly efficient and serviceable engines, which shall do credit to the builders.

I have, &c.,

H. McLACHLAN,

Secretary.

Re Locomotives.

The Commissioners for Railways, Sydney,—

Dear Sirs,

Sydney, 24 September, 1890.

We have the honour to acknowledge your letter of the 22nd instant. Immediately on receipt of same copy was forwarded to the Baldwin Company, we also cabled to them as follows :—

"Commissioners have accepted offer of twelve locomotives landed at Sydney 15,000 dollars."

The mail *via* San Francisco will leave Sydney on 1st October, and we shall be very pleased to forward any documents or particulars which you may desire to send.

Terms of payment will, we presume, be as usual, *i.e.*, 85 per cent., to be paid on shipment by credit on Agent-General, London, balance on delivery, Sydney.

We remain, &c.,

R. TOWNS & CO.

New South Wales Government Railways,

Secretary's Office, Sydney, 1 October, 1890.

Sir,

I enclose you herewith six tracings referred to in my letter to Messrs. R. Towns & Co., of this city, of the 22nd ultimo, and in accordance therewith would wish you to work exactly to the tracings of the draw hook and contour of tires. I should be glad if you would follow as closely as possible the Turton buffer, which is our standard, and which is a well-known article of commerce, and which you doubtless can procure from Sheffield (England), where they are made in large quantities. The connecting rod ends we send you have been found to work very well in practice, and we would like something of the same style, but larger dimensions to suit the increased size of cylinder and higher pressure. Those we send you are used for engines with 18-inch cylinders and 140 lb. pressure, and have been running for a good many years.

The tracing showing the cylinder flange is a method which has suggested itself as a means to keep the extreme width of the engine within the 9 feet 3 inches limit ; if, however, you can carry out a preferable plan to effect the same object without reducing the distance apart of the centres of the cylinders, and so shortening the crank pins, I shall be glad if you will do it.

You will, of course, readily understand that we wish good bearing surfaces, and would prefer flattening the flange in some way to shortening the crank pins.

I have, &c.,

H. McLACHLAN,

Secretary (*per* A.P.)

The Manager the Baldwin Locomotive Works,

Baldwin Locomotive Works, Burnham, Parry, Williams, & Co., Philadelphia, 4 November, 1890.

Mr. H. McLachlan, Secretary Government Railways, New South Wales, Sydney, Australia,—

Dear Sir,

We acknowledge receipt of your valued favour of October 1st, together with six drawings showing respectively the buffers, draw-bars, section of tires, styles of main rod ends, and method suggested of reducing the width over the cylinders of the twelve ten-wheel passenger locomotives which we are to build for your railways. We will be governed by your wishes as expressed by these drawings. We regret that it is necessary to restrict the width of the engine within a limit of 9 feet 3 inches, as we fear

it will considerably interfere with the convenience of the enginemen. We will, however, make the most desirable arrangement practicable. We note your desire to avoid shortening the crank-pins, and we will take care to provide ample bearing surfaces with efficient means of lubrication.

Yours, &c.,

BURNHAM, PARRY, WILLIAMS, & CO.

(A. S. JOHNSON).

Government Railways of New South Wales,

Secretary's Office, Sydney, 19 December, 1890.

Gentlemen,

Referring to your letter of the 4th ultimo respecting the restriction of the width of the engine within a limit of 9ft. 3in., I have the honor to confirm cablegram sent to you on the same subject, viz., that the 9ft. 3in. only refers to a height of 5ft. from the ground, above that the extreme width may be 9ft. 6in.

I have, &c.,

H. McLACHLAN,

Secretary.

Messrs. Burnham, Parry, Williams, and Co., Baldwin Locomotive Works, Philadelphia, U.S.A.

Baldwin Locomotive Works,

Burnham, Parry, Williams, and Co.,

Philadelphia, 10 October, 1890.

Messrs. R. Towns & Co., Sydney, New South Wales,—

Gentlemen,

Your two favours of September 2nd are to hand, together with the letter of same date from Mr. McLachlan, Secretary for Railways, communicating the Government's requirements for twelve ten-wheel passenger locomotives similar to those built by us for the Baltimore and Ohio Railroad Company, and mentioned on page 420 of the *Railroad Gazette* of June 13 last. Before receiving these letters we have been in communication with you by wire, having duly received your messages of September 2nd, 9th, 19th, 22nd, and two of 23rd, and replied to same September 5th, 15th and 19th, all as per copies enclosed.

We observe that your message of September 2nd was sent specifying delivery "in steam, Redfern," whilst it was delivered to us "in steamer Redfern." We presumed an offer was desired including delivery f.o.b. Sydney by steamer, the word in being used as less likely to be misunderstood or altered in transmission than f.o.b. We presume our reply of September 5th made this clear. Basing our estimates on Dr. Williams' experience with the engines shipped per "Niobe" in 1879, we are willing to undertake the erection under steam at 300 dollars each, exclusive of cost of shop space. The propositions cabled you for these engines have been as follows:—

Engines like those for the Baltimore and Ohio Railroad, page 420, *Railroad Gazette*, 13th June last, but with copper fire-box, iron flues, hand brake, and Westinghouse automatic brake on drivers and tender, steel-tired truck and tender wheels and spring buffers, f.o.b. steamer at Sydney, each 15,000 dollars, or if delivered f.o.b. in New York, 13,500 dollars; additional for screw reverse gear, each, 75 dollars; copper stay-belts, if required, 540 dollars; for discharging at Sydney, if required, 200 dollars; brass tubes, if required, 1,650 dollars; deduct if weight is reduced to 32,500 lb. per axle each engine, 200 dollars. Enclosed please find specification No. 5,173, which was prepared before receipt of your message limiting the weight. It describes engines of the same dimensions as those furnished the Baltimore and Ohio Railroad, but owing to the change of copper fire-box the weight is somewhat greater than the B. and O. engines.

The proposed reduction of weight per axle, will, we fear, cause disappointment in the performance of the engines. We judge the same work is expected of them as that stated in the *Railroad Gazette* as being performed by the Baltimore and Ohio engines. It should be fully understood that their efficiency will be correspondingly reduced. As we understand that the permanent way of the New South Wales railways is of a much more substantial character than the Baltimore and Ohio railroad, we see no reason why the engines built for the latter should not be adopted entire. We should be gratified if, on further consideration, this is decided upon.

Since receipt of Mr. McLachlan's letter we have gone carefully over the details mentioned. We submit specification No. 5,231, of locomotives of the stipulated weight and details of construction. In preparing this design we have endeavoured to provide the maximum heating surface and interchangeability where practicable with locomotives previously supplied by us to your railways. With reference to the suggestion of the reduction of the grate area, as the *Railroad Gazette* contains no detailed description of the Baltimore and Ohio engine, it occurs to us that the railway authorities have based their conclusions upon the drawings published in the same paper, of a 10-wheel passenger locomotive for the New York, Lake Erie, and Western Railroad. We explain that the latter was designed for burning anthracite coal, which requires a specially large and rather shallow grate. The furnace was therefore made 11 feet long, and placed over the frames, giving an inside width of nearly 43 inches. The B. and O. engine, on the contrary, was designed to burn the best quality of bituminous coal. It is generally considered that there is no coal produced in this country of better quality than that mined on the line of the B. and O. R. R. As bituminous coal requires greater depth for proper combustion, we dropped the fire-box between the frames, making it 33 inches wide, and shortening it from 11 feet to 10 feet. We were at first disposed to think it too small, but further service confirmed the correctness of the dimensions adopted. As we believe it to be just right, we should regret to change it, and have not therefore altered it in preparing the enclosed specification. We fear difficulty in steaming with less grate area.

To secure interchangeability with the Middelton Moguls, we propose driving-wheels 61 inches diameter. In consequence of this smaller diameter, and of the somewhat reduced weight, we propose making the cylinders 21 x 24, instead of 21 x 26 inches. This will give correct proportions of cylinder power to adhesion, with a boiler pressure of say 150 lb. The B. and O. engines carry 160 lb.

The B. and O. engines have their crown sheet supported by radial stay-bolts 1 inch diameter, with upset ends, tapped through crown sheet and roof of boiler, and riveted over at both ends, care being taken to arch the sheets so as to have the bolts as nearly as possible at right angles to both sheets, as shown in the engraving of the N. Y. L. E. and W. locomotive, page 414 of the *Railroad Gazette*,
June

June 13th. We believe this to be the simplest and strongest construction, and adopt it without hesitation with steel fire-boxes. With fire-boxes of copper, which expands at about double the rate of steel, we have had some doubts about using the radial stay-bolts, but these doubts have been removed by experience with engines so constructed for the Dom Pedro Second railway of Brazil. Some fifteen years ago we built six Mogul locomotives for this road, with copper boxes and radial stays. We have repeatedly made inquiries as to the results which they have given. These are indicated by enclosed copy of a letter from Dr. Niemeyer, the locomotive superintendent. As there is a saving of about 4,000 lb. weight by this construction, as compared with crown bars, we propose adopting it. If this is not approved we will support the crown by crown bars without extra charge. The change if required will, however, involve either an increase of about 4,000 lb. to the weight of the engine, all of which will come on the driving-wheels, or a corresponding reduction in the dimensions and capacity of the boiler. A method of decreasing the increased weight some 2,000 to 2,500 lb., if crown bars are desired, is to substitute wrought-iron for cast-iron driving-wheel centres. Their extra cost is estimated 100 dollars each, or 600 dollars per engine. We append code words for use in this connection.

Our offer of steamer, delivery, and discharging, is based upon the following conditions, which, from consulting with Dr. Williams, we understand prevail at Sydney:—

1. Steamer can discharge from ship's side to railway pier, where cars can come alongside to receive cargo.
2. Sufficient water at discharging berth to lie safely in all times of tide.
3. Discharging berth to be immediately available on arrival of steamer, or demurrage to be at the expense of the Government.
4. Cars to be tendered to receive cargo as fast as it can be discharged through all the steamers' hatches at the same time, and switching to be done promptly as required without cost to the ship.

We understand the new railway piers at Redfern have been completed, and that there is now a draw in the Pyrmont Bridge large enough for the passage of the largest steamers.

The price of each engine as per enclosed specification No. 5,231 and as per our cable quotations recited above will be:—Cost of locomotive with steel boiler, copper fire-box, screw hand brake, and Westinghouse automatic brake on driving-wheels and tender, spring buffers, &c., but with iron tubes, iron stay-bolts, discharged at Sydney as above, each, 15,000 dollars; additional for screw reversing-gear, 75 dollars; brass tubes, 1,650 dollars; price as per specification No. 5,231, 16,725 dollars. This price does not include duplicate parts other than the usual tools and accessories enumerated in the specification. We quote separately for such a supply as we presume may be required, prices for same including delivery, and being subject to the other conditions of the locomotive contract.

Our offer includes the services of a competent engineer to supervise the erection of the locomotives; all necessary labour, tools, and supplies being furnished by the Government, but no charge being made by us for his time or expenses. He will run each engine one or more trips on trial, to make sure that it is in efficient working order before being finally put into regular service. We trust a width of 9 ft. 6 in. over all can be allowed us, as suggested, as even this we fear will be difficult to work to where the diameter of the boiler is so large and a screw reverse is to be provided. We will adopt this width unless we are otherwise directed. We presume the terms of payment will be the same as in previous contracts viz.: 85 per cent. cash by the Agent-General in London, on production of shipping documents, and the remaining 15 per cent. by the Colonial Treasurer, on arrival of the vessel carrying the locomotives. We also confirm the sale of fifteen motors, at 5,000 dollars each, delivered over ships' side at Sydney, terms of payment and other conditions as above. We understand these motors are to be duplicates of those shipped per "Luxor," in 1885, singled gear, with hollow crankpins. All rods, main and connecting, to have solid ends and bronze bushings, and the axles to be made of steel. We await further instructions as to the axle-boxes as directed. As the figure which we accept for these motors is an exceptionally low one, in consequence of the large shipment we are enabled to make, and other special circumstances prevailing at this time, it should not be regarded as a precedent. Our prices for the same machines are likely to be higher in any new quotations.

We expect to have the entire twenty-seven machines ready for shipment by the end of February. We are now chartering a steamer to begin loading at that time.

We remain, &c.,
BURNHAM, PARRY, WILLIAMS, & CO.

Messrs. Burnham, Parry, Williams, & Co., Baldwin Locomotive Works, Philadelphia,—

Gentlemen,

Rio de Janeiro, 10 November, 1888.

I just received to day, 7 a.m., your favour of 9th October, 1888. I thought I had replied about these questions when you asked me before, but I do it again now, and can give you assurance that the engines from No. 83 to 88, which had their fire-box crown sheets supported by radial stay-bolts screwed and riveted, work very satisfactorily, as well as our others in usual manner.

I remain, &c.,

CARLOS DE NIEMEYER.

17 November, 1890.

Having carefully considered the specifications 5,173 and 5,231, enclosed in a letter from the Baldwin Locomotive Works to Messrs. R. Towns and Co., of Sydney, dated 10th October, 1890, I consider the engine in specification No. 5,231 would meet our requirements, with the following modifications:—

1. Steam-ports made wider.
2. Boiler pressure increased from 150 to 160 lb. per square inch.
3. Cast-steel driving-wheels adopted instead of wrought-iron, as suggested by the makers; this will lighten the engine.
4. The width over cab 9ft. 6in. over all, width over cylinders 9ft. 3in. over all.
5. Radial stays adopted for fire-box, as suggested by the makers.
6. The boiler barrel preferred $1\frac{1}{8}$ in. thick instead of $\frac{1}{2}$ in.

According to the makers offer, the price delivered at Sydney would then be £3,557 each (\$17,325) or at the rate of £54 15s. per ton, which I consider very moderate. I estimate the engines would be fully equal in power to those recently ordered in England, and would haul five loaded lavatory carriages and two 28-ton sleepers up a long gradient of 1 in 40 at 22 miles per hour.

I would advise the Baldwin Locomotive Works be cabled to this effect:—
 “Approve 5,231, but steam-ports wider; require high-speed boiler pressure; 160 lb. plates nine-sixteenths cast steel drivers, width cab nine six, cylinders nine three.”

D. H. NEALE.

I concur.—E. A. LOUGHRY.

Government Railways of New South Wales,

Gentlemen,

Secretary's Office, Sydney, 18 November, 1890.

Your letter of the 15th November, together with the communication received by you from the Baldwin Company, have been laid before the Commissioners, and after considering the whole question, they will be glad if you will cable to the Baldwin Company to the following effect:—

“Approve 5,231; high speed necessary; steam-ports should be wider; boiler pressure 160 lb.; plates $\frac{9}{16}$; cast-steel drivers; width over cylinders must not exceed 9 ft. 3 in.; width of cab may be 9 ft. 6 in.

I have, &c.,

H. McLACHLAN,

Secretary.

Messrs. R. Towns and Co., Margaret-street.

The Commissioners for Railways, Sydney,—

Dear Sirs,

Sydney, 12 January, 1891

We have the honor to enclose herewith letter received per mail just arrived from the Baldwin Locomotive Company, dated 20th November, the contents of which will, we trust, be satisfactory to you.

Under date 28th November the Baldwin Company write in reference to locomotives:—

“As we have already advised you, we are in excellent position to furnish prompt deliveries of these locomotives. We are now completing a new erecting-shop, having trackage space for the *simultaneous erection of sixty-five locomotives*. This shop is fitted with two electric travelling cranes, each of 100 tons capacity. With their assistance we expect to be able to construct twenty-four locomotives per week, whilst the increased facilities, improved machinery, and superior light will enable us to improve the quality as well as the quantity of our work.”

We are, &c.,

R. TOWNS & CO.

[Enclosure.]

Baldwin Locomotive Works (Burnham, Parry, Williams, & Co.),

Philadelphia, 20 November, 1890.

Messrs. R. Towns & Co., Sydney, New South Wales, Australia, *via* England.

Gentlemen,

We have received your message of the 18th instant, as follows:—

“Government adhere to dimensions as specification 5,231, but modified as follows:—High speed necessary; steam-ports should be wider; boiler pressure, 160 lb.; plates, nine-sixteenths. Government accepts offer to supply wrought iron driving-wheel centres of cast steel. Cylinders:—Government will allow only 9 feet 3 inches for extreme width of cylinders, but cab allowed 9 feet 6 inches.”

We have accordingly entered the order of the Government for wrought iron driving-wheel centres at \$100 each wheel, or \$600 each engine additional. We note that we are allowed a width of 9 feet 3 inches over cylinders and 9 feet 6 inches over cab. We will thicken the steel plates of the boiler shell to nine-sixteenths inch, as desired, and will make no additional charge therefor; but we call attention to the fact that this involves adding about 1,500 lb. extra weight.

Our specification, No. 5,231, was in error in proposing a waggon-top boiler. This error was merely clerical, the number of tubes and other dimensions being correctly stated for the straight-top boiler intended. The restricted limit of width makes it important to adhere to the straight form of boiler, as does the desirability of reducing the weight on each driving axle. The waggon-top boiler would throw a considerably larger proportion of the weight of the engine on the driving-wheels. We therefore assume that the straight-top boiler will be acceptable, and we are proceeding with work accordingly. We send this letter *via* England, hoping it may reach you before the next mail *via* San Francisco.

Very truly yours,

BURNHAM, PARRY, WILLIAMS, & CO.,

(*Per* A. B. JOHNSON).

To the Secretary to the Railway Commissioners,—

Re Locomotives.

Dear Sir,

Sydney, 15 December, 1890.

The following is extract from letter received by us this day from the Baldwin Locomotive Company. We forward same for your information:—

“We have carefully considered the conditions of service for which these locomotives are intended, viz., to haul 152 to 176 gross tons of cars and load at a speed of 22 miles per hour up long grades of 136 feet per mile combined with severe curvature, and to haul up grades of 176 feet per mile with easier curvature, loads of 120 to 144 gross tons. We note that the sharpest curves are of 528 feet radius, but it is not stated that this is the radius of the curves in combination with the 130-foot grade. Our calculations indicate that the engines will have sufficient tractive force to haul these loads, but we prefer not to make a definite guarantee of the speed, as it is more or less dependent upon conditions of which we are not fully informed, such as the quality of the coal, the wheel base of the rolling-stock, condition of track, &c.”

“In order to compare the stipulated performance with what the B. and O. engines are actually performing in daily service, we telegraphed the general superintendent of motive power of that company inquiring as to the latter, and have the following telegram in reply:—

“Have never had maximum load weight taken up 17-mile grade by 1300 class engines. It is about 240 net tons at schedule speed of 22 miles per hour, exclusive of weight of engine and tender. The 240

tons

"tons of 2000 lb. are equal to 214 tons of 2,240 lb. There is much curvature on the 117-foot grade, and we are informed that in some places the actual grade considerably exceeds 117 feet per mile. The latter is the theoretical grade as shown by the profiles. The B. and O. locomotives have a total heating surface of 1,945 square feet, whilst the heating surface of the proposed locomotives, as per specification No. 5,231, is 1,937 square feet. From these data you can readily judge as to the power and speed of the new engines.

"We will supply iron pilots, and in all other respects not specially herein mentioned conform to the details desired in the Commissioners' letter of 22nd September."

We have, &c.,
TOWNS & CO.

Government Railways of New South Wales,

Gentlemen,

Secretary's Office, Sydney, 29 December, 1890.

With reference to the twelve express passenger engines ordered in September last, kindly note these should be numbered from 446 to 457 in plain block letters 7 inches high, in gold, on the sides of the cab, on the front buffer beam, and the back of the tender tank.

I think it well to inform you that our 12° curves on which these engines will work are on 160-foot grades, and that the worst curves on the 130-foot grades are about 7°. All our passenger rolling stock is carried on trucks chiefly four-wheel, with about 5' 6" wheel base. All the axle-boxes are made for oil; all the wheels under the rolling stock are 36" diameter, on tread and steel tyres.

We calculate that to take a train up the 130-foot grades at 22 miles an hour will require about 50 indicated horse-power less than is wanted by the Baltimore and Ohio engine during its maximum work, and, as in our weight for the train (176 tons gross exclusive of engine and tender) we include an ample allowance for the weight of passenger and baggage, we anticipate that the engine will be fully equal to this performance. We should, however, be glad of your confirmation on this point.

I enclose herewith a list of duplicate parts required, with prices as supplied by Messrs. Towns & Co.

I have, &c.,
H. McLACHLAN,
Secretary.

The Baldwin Locomotive Company, Philadelphia, Pa., U.S.A.

The Commissioners for Railways, Sydney,—

Dear Sirs,

Sydney, 5 February, 1891.

At your request we cabled to the Baldwin Company to know what progress was being made with the locomotives on order, and we have just received the following: "First order locomotives in progress rapidly," which we trust will be satisfactory.

We have, &c.,
R. TOWNS & CO.

H. McLachlan, Esq., Secretary N.S.W. Railways, Sydney,—

Dear Sir,

Sydney, 19 March, 1891.

Our friends, Messrs. R. W. Cameron & Co., write from New York *re* the advisableness of shipping the engines to come forward in May per sailer instead of per steamer.

The Baldwin Company are under contract to ship these per steamer, and on 30th January advise that they were inviting tenders for a steamer to carry them. Tenders to be opened and contract closed on 2nd March.

Messrs. Cameron have discussed the question with Mr. Thow and have written to him on the matter. They consider that the engines can be delivered as advantageously by sailer as per steamer, and desire that instructions may be cabled to the Baldwin Co. to ship per R. W. Cameron's line of sailing vessels.

Will you be good enough to favour us with the Commissioners' views on the matter? If they decide per sailer, we would on behalf of Cameron bear the expense of a cable to them.

With reference to the twenty Consolidation freight locomotives, the Baldwin say that they fear the detail particulars will arrive too late, as the work is well advanced. Mr. Thow, however, saw the specifications. At the time of writing, it was the intention of the Baldwin Co. to send Mr. Rhodes to take charge of the erection of locomotives.

We have, &c.,
R. TOWNS & CO

New South Wales Government Railways, Secretary's Office,

Gentlemen,

Sydney, 21 March, 1891.

Referring to your letter of the 19th inst., intimating that Messrs. Cameron & Co. suggest that the twenty goods engines manufactured by the Baldwin Locomotive Co. for this Department may be shipped by their line of sailing vessels, I have the honor to inform you that the conditions of contract—providing for shipment by steamer—cannot be departed from, as speedy delivery of the engines is one of the principal objects aimed at by the Commissioners.

I have, &c.,
H. McLACHLAN,
Secretary.

Messrs. Towns & Co., Sydney.

H. McLachlan, Esq., Secretary N.S.W. Railways,—

Dear Sir,

Sydney, 24 March, 1891.

We have just received a cable from the Baldwin Company informing us that the s.s. "Henley," 2,243 tons register, classed A1 100, and built 1887, takes the first shipment of locomotives and motors, in place of the s.s. "Dunmurry" which has been disabled. The "Henley" is now loading.

We have, &c.,
R. TOWNS & CO.
The

The Commissioners for Railways, Sydney,—

Dear Sirs,

Sydney, 22 April, 1891.

We have to-day been advised by cablegram received from London, that the s.s. "Henley" left Philadelphia for Sydney, on 16th April. We judge this vessel should make the passage direct to Sydney in something under 60 days, and therefore will be due here about middle of June at latest.

We have, &c.

R. TOWNS & CO.

The Commissioners for Railways, New South Wales,—

Dear Sirs,

Sydney, 21 May, 1891.

We have just received advice from the Baldwin Locomotive Co. confirming the date of the "Henley's" departure on 16th April.

They also advise us that the "Strathdon" is to sail on 15th June.

We have, &c.,

R. TOWNS & CO.

Wm. Thow, Esq., Chief Mechanical Engineer, Government Railways, Eveleigh,—

Dear Sir,

Sydney, 18 July, 1891.

At the request of Mr. Rhodes we have pleasure in handing you extract from letter from the Baldwin Locomotive Company, dated 26th December last, referring to the engine wheels on the locomotives just landed ex s.s. "Henley."

Yours, &c.,

R. TOWNS & CO.

[Enclosure.]

Copy of extract of the Baldwin Co.'s letter, dated 26th December, 1890.

WE note the letters received from Mr. McLachlan, Secretary for Railways, and are glad to learn that we are constructing the locomotives in accordance with his wishes. We have elected to furnish driving-wheel centres of wrought-iron, rather than cast-steel, for the reason that no cast-steel centres have as yet been manufactured or used in this country, and we feel some hesitation at undertaking anything at all experimental in locomotives to be sent so far. We are therefore forging the wheels of wrought-iron. We are of the opinion that it has important advantages over any method heretofore devised for doing the work, and as the finished wheel centres will be entirely free from internal strains, we consider them more reliable than any steel casting.

Copy of cable from R. Towns & Co., to Messrs. R. W. Cameron & Co., New York, 24 August, 1891.

"TELEGRAPH immediately for Government how many six-wheel coupled passenger and eight-wheel Consolidated goods the same as "Henley" "Strathdon" are running America, is result satisfactory generally? Consult Forney advise weight rail Baltimore."

Copy of cable from R. W. Cameron & Co., to Towns & Co., 27 August, 1891.

"EIGHT-WHEEL goods in general use with favourable results, weight better distributed and less destructive to rails; coupled six-wheel passenger same result as to rails over four-wheels, with increasing demand for heavy trains, especially on Western Roads, but not used on Pennsylvania or New York Central. They preferring dividing trains. Baltimore steel rails 67 pounds per yard."

Sydney, 9 September, 1891.

The Secretary, N. S. Wales, Government Railways.

Sir,

We have the honor to enclose invoice of the 10 per cent. due on the twelve locomotives ex "Henley," say £4,466 5s., and we shall be obliged by your passing the same as far as possible so that on receipt of the certificate from the engineer that they have run their 1,000 miles we may have no delay in getting voucher for the balance.

We understand that about eight of them have run more than the required mileage and the other four should do so within the next few days.

We shall be glad to receive your account for sundry alterations and repairs which will be dealt with at once.

Yours, &c.,

R. TOWNS & Co.,
Agents for Baldwin Loco. Co.

Dear Sir,

Sydney, 19 September, 1891.

Referring to our letter of 9th instant, we shall be glad to know if you have yet received return of the completion of mileage of the Baldwin Company's engines.

We have, &c.,

The Secretary, N.S. Wales Government Railways, Sydney.

R. TOWNS & Co.

Government Railways of New South Wales,

Gentlemen,

Sydney, 24 September, 1891.

In reply to your letter of the 19th instant, relative to mileage performed by the Baldwin engines, I have to inform you that up to the present ten of the engines have completed the specified distance of 1,000 miles, and the remaining two will shortly complete the same distance.

I have, &c.,

H. McLACHLAN,

Secretary.

Messrs. R. Towns & Co., Sydney.

Sydney,

Sydney, 17 November, 1891.

The Secretary, New South Wales Government Railways,—

Dear Sir,

Referring to your personal request that I would inform you how the engines *ex* "Henley" differ from those of similar class in America, I have the honor to report as follows:—

The difference between them is that the former have copper fire boxes and brass tubes, screw-reversing gear, screw engine and tender brakes, and a few other minor details.

The pattern Baldwin Engine has only been departed from to keep the engines within a limit of weight, height, and width, and I do not consider any of these departures an element of weakness.

I have, &c.,
 WR. RHODES.

Copy of cable despatched by R. Towns & Co. to R. W. Cameron & Co., 18 November, 1891.

"WE have to report the failure of Baldwin Locomotive Company passenger bogie axles through fast running. Has been affirmed it is not usual run similar class engines high speed America. What is the practice in such cases Government must know by cable. Time-table speed long fast runs similar class-confidential. Do not refer to Baldwin Locomotive Company."

Copy of cable from New York, addressed to R. Towns & Co., 21 November, 1891.

"HAVE returns nine railroads using similar engines; distances 100 to 350 miles; weight of cars 185 tons; 380 tons Baltimore, Ohio, Michigan Central and Erie Roads; speed per time-table up to 50 miles per hour. Erie considers them best engines built; just placed order with Baldwins for forty-five; intend equipping their entire roads; opinion expressed; cause of failure, bogie axles improperly lubricated, or sand heating bearing journals."

Government Railways of New South Wales,

Secretary's Office, Sydney, 27 November, 1891.

Gentlemen,

We regret to have to inform you that several defects have been found in the passenger engines received from your firm. The most serious of these are in breakages of bogie and tender axles. Before writing to you on these matters we have had the material in the broken axles carefully tested by an independent engineer, and we send you copy of the results obtained from his investigation; these we have marked "A" and "B." You will also find enclosed copies of the results obtained by our Works Manager from the falling weight machine belonging to this Department. These papers unmistakably disclose the unsatisfactory quality of the iron employed in the axles which have broken. You will notice from Professor Warren's results that the tensile strength in lbs. per square inch is below your printed standard tests for ordinary bar-iron, whereas the elongation is infinitely below the limit which you name as the lowest acceptable for ordinary bar-iron, and we assume that you will agree with us that the axles of locomotives should be of higher quality than ordinary bar-iron. At first we were uncertain as to whether the breakage of the axles was due to inferior material or to imperfect lubrication, which permitted the axle to get hot, and might have led to fracture, but the tests we have made fully show that it is the inferiority of the material which is the cause. Care has been taken to select the test-bars from those portions of the axle which could not have been affected by any heating of the journals, and there is no doubt that the results obtained from the drop tests are in themselves conclusive of bad iron. We shall replace the axles of the bogies with those which you have been asked by cablegram to send, and the tender axles will be replaced by others which we have in stock.

We shall renew the axle-boxes of the bogies so as to admit axles of larger diameter, as we consider larger axles are desirable for the work which the engines have to do, and in order to minimise the alteration in the bogie, we shall make new boxes of solid gun-metal, so as to suit the present horns. We shall, of course, debit you with the cost of these alterations, as they are entailed by the inferiority of the material in the axles supplied under the engines and tenders.

We may say that the coupled axles of the same engines do not appear to be of a quality of iron good enough for locomotive purposes, and it is not unlikely that we may conduct some tests for ascertaining their reliability or otherwise.

There are other matters of minor importance, which we shall expect to debit against your account, such as the draw-hooks sent out with these engines and tenders, as well as with the Consolidation engines.

You will remember that a tracing was sent to you showing the form of hook that we use, but we find that instead of adhering to the dimensions thereon shown, the hook is nearly $\frac{1}{2}$ in. less in depth, and instead of having the breaking strength specified in your specification, viz., of at least 100,000 lb., some that have been tested, we find, fracture at between 80,000 and 90,000 lb. They are too light for our work, and are breaking on the road. We are replacing them all with stronger hooks. I may add there is an amount of £7,400 due to you as retention money on engines, and we consider it necessary to retain this money pending adjustment of accounts.

While feeling compelled to write you in this way, we are sure the occurrence is due to one of those accidents which occur in the conduct of the best managed establishments, and that you value the reputation of your firm—on which we entirely relied—so highly as to be equally anxious with the Commissioners to fully remedy the defects which have been ascertained.

I have, &c.,

H. McLACHLAN,

Secretary.

Messrs. The Baldwin Locomotive Company, Philadelphia, U.S.A.

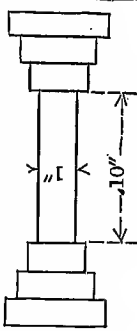
UNIVERSITY OF SYDNEY.
RESULTS of testing Iron cut from Baldwin Locomotive Axles.

Test Number.	Description.	Original Dimensions.		Strain in Pounds.		Strain in Tons.		Limit of Elasticity.	Contracted Dimensions.		Contraction of area %.	Elongation, %.	Remarks.
		Breadth.	Thickness.	Total.	Per sq. inch.	Total.	Per sq. inch.		Breadth.	Thickness.			
A	Turned specimen length over which elongations were measured, 10 inches.	0.75	diam.	21,850	49,456	22.07	12.03	0.700	diam.	0.3,848	12.9	11	Very coarse crystalline fracture.
B		0.7495	"	17,150	43,404	19.36	14.53	0.749	"	0.4,391	2.5	4	" " with lamination.
C		0.7495	"	20,100	47,144	21.04	.....	0.620	"	0.3,014	31.6	13	Dull fibrous fracture.

W. H. WARREN, M. Inst. C.E.,
Professor of Engineering.

16 November, 1891.

UNIVERSITY OF SYDNEY.
RESULTS of testing Iron cut from Axles of Baldwin Locomotive Engines.

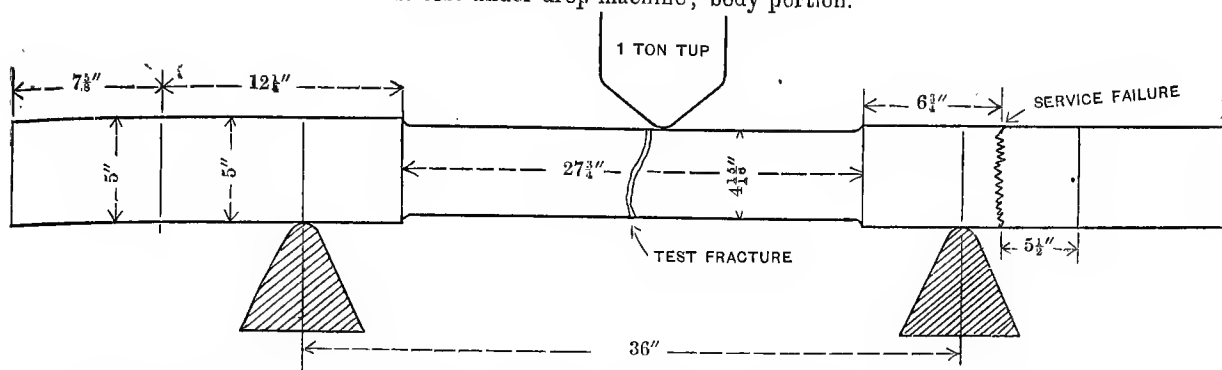
Test Number.	Description.	Original Dimensions.		Strain in Pounds.		Strain in Tons.		Limit of Elasticity.	Contracted Dimensions.		Contraction of area %.	Elongation, %.	Remarks.
		Breadth.	Thickness.	Total.	Per sq. inch.	Total.	Per sq. inch.		Breadth.	Thickness.			
A 1 } 452 }	 Turned in a lathe to 1 inch diameter. Elongations measured on the length marked 10".	1.00	Diameter	34,850	44,372	19.8	11.55	.95	Diameter	.7,088	9.7	8.0	Very coarse crystalline fracture, with flaws.
A 2 } 452 }		"	"	36,850	46,918	20.9	10.45	.897	"	.6,319	19.5	14.2	Laminated and crystalline part of fracture appears burnt.
A 3 } 452 }		"	"	37,100	47,236	21.0	11.30	.921	"	.6,662	15.0	13.7	2/3 crystal; 1/3 burnt.
A 4 } 452 }		"	"	37,500	47,746	21.3	10.24	.922	"	.6,676	14.9	13.0	Coarse crystalline fracture.
A 5 } 456 }		"	"	33,400	42,525	18.9	9.45	.916	"	.6,734	14.2	9.0	1/4 crystal; 3/4 burnt.
A 6 } 456 }		"	"	36,400	46,345	20.6	11.30	.965	"	.7,314	6.8	5.7	Very coarse fracture.
A 7 } 456 }		"	"	36,250	46,154	20.6	10.3	.901	"	.6,376	18.8	13.0	1/2 crystal; 1/2 burnt.
A 8 } 456 }		"	"	29,250	37,242	16.6	11.3	.970	"	.7,390	5.9	4.0	2/3 crystal; 1/3 burnt.

W. H. WARREN,
Professor of Engineering.

24 November, 1891.

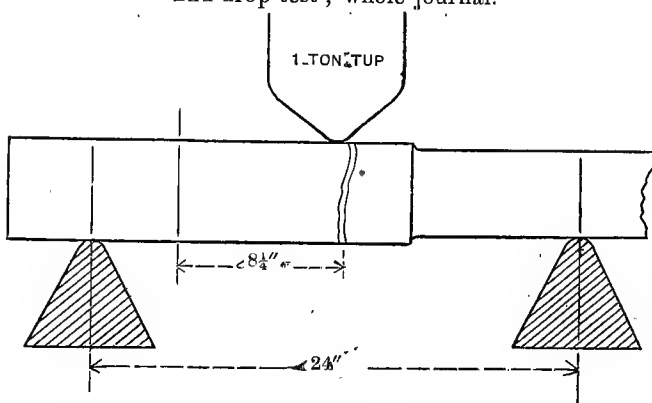
Eveleigh Works, 30 October, 1891.
Test of engine bogie axle from No. 457 engine (new American passenger); failed in service at Redfern on 28th October, 1891.

1st test under drop machine; body portion.



Axle broke with first blow, 15 feet drop, and apparently with very slight resistance. Locality of fracture, about $1\frac{1}{4}$ inch to one side of blow centre; quality of fracture, mostly crystalline, but good colour. Considerably less drop would probably have fractured this axle.

2nd drop test; whole journal.



Axle broke at an almost continuous circumferential flaw, with 1 foot drop, and apparently very slight resistance.

NOTE.—The flaw here mentioned had been considerably shaken and aggravated by the first or body test, and was found to penetrate from $\frac{1}{4}$ inch to $\frac{1}{2}$ inch deep, or about $\frac{3}{8}$ inch average all round, except at two spots, one about $\frac{7}{8}$ inch long and the other about $\frac{1}{4}$ inch long; very slight signs of fibre and mostly crystalline, like previous fracture.

J.C.

Eveleigh Works, 11 November, 1891.

Test of two samples of wrought-iron (hammer forged) machined from the broken bogie axle of an American passenger engine; Redfern accident. Samples, $1\frac{1}{2}$ inch square turned down for 10 inches to 1 square inch sectional area.

1st Sample.
Tons. 0.32" elongation in 10".

- | | |
|---|--|
| 6 | Not tested. |
| 7 | Sample failed at square end in one grip, the fracture showing crystalline and indications of pre-existing trans. flaw or shake right through, proved by water rust-marks. Material apparently rotten, and resembling case-hardened wrought-iron. |

2nd Sample.
Tons. 0.32" elongation in 10"

- | | |
|----|----------------------------------|
| 5 | Nil. |
| 7 | " |
| 8 | " |
| 9 | " |
| 10 | " |
| 11 | " |
| 12 | 2.32" |
| 13 | 4.32" |
| 14 | 7.32" |
| 15 | 10.32" |
| 16 | 12.32" |
| 17 | 15.32" signs of straining. |
| 18 | 20.32"b. " |
| 19 | 25.32"b. " |
| 20 | 1.2.32" |
| 21 | 1.2.32" |
| 22 | Axle broke without lifting beam. |

Breaking strain, 22 tons.

Ult. elong. in 10", $11\frac{1}{4}$ " = 12.5%.

Reduction of sec. area at fracture (1") = 21.5%.

Frac. about 50% fibrous, balance fine hard looking crystal.

J.C.

New South Wales Government Railways,

Secretary's Office, Sydney, 30 November, 1891.

Gentlemen,

I have the honor to inform you that we have written to the Baldwin Company, intimating that the passenger engines recently supplied have developed defects, and that we should look to them to make good the same. We shall, therefore, claim in due course.

I have, &c.,

H. M'LACHLAN,

Secretary.
Gentlemen,

Messrs. R. Towns & Co., Sydney.

New South Wales Government Railways,

Gentlemen,

Secretary's Office, Sydney, 7 December, 1891.

Adverting to my letter of the 27th ultimo, I beg to say that a clerical error was made in the enclosed copy of Professor Warren's tests marked "B." You will notice in the eighth test (A 8-456) that the total strain in pounds is given as 37,242. This, however, should read 29,250. The strain per square inch is correct as given, namely, 37,242.

Will you kindly note?

I have, &c.,

H. McLACHLAN,

Secretary.

Messrs. Burnham, Barry, Williams, & Co.,

Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.

The Secretary, N. S. Wales Government Railways,—

Dear Sir,

Sydney, 11 January, 1892.

As the freight engines ex "Strathdon" have now completed their mileage, we shall be obliged by your passing on the enclosed voucher for £7,427 1s. 8d. for payment, as we are anxious to remit same or a portion of it by the mail leaving on 25th instant.

We remain, &c.,

R. TOWNS & CO.

New South Wales Government Railways,

Gentlemen,

Secretary's Office, Sydney, 13 February, 1892.

With reference to previous letter relative to defects in locomotives supplied by the Baldwin Company, I am directed to inform you that, in order to be secure, we are having all engines examined as opportunity offers, and remedied any defects that may have been found in the axles. The cost of the work to date has been as follows:—

	£	s.	d.
Alterations to bogie axles, axle-boxes, and bogie-wheel bosses of engines...	555	11	1
Replacing condemned axles on tenders with new steel ones	59	16	3
	£615	7	4

This amount will be deducted from the retention money now in Commissioners' hands, and the Commissioners trust the Company will see the justice of this proposal.

I have, &c.,

H. McLACHLAN,

Secretary.

Messrs. Burnham, Parry, Williams, & Co.,

Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.

Baldwin Locomotive Works (Burnham, Williams, & Co.),

Philadelphia, 15 February, 1892.

Mr. H. McLachlan, Secretary, Government Railways of New South Wales, Sydney, N.S.W.,—

Dear Sir,

Your two favours of November 27th and December 7th were duly received, but our reply has been unavoidably delayed. It is with the utmost regret that we have learned of the breakage of the engine and tender axles of the twelve ten-wheel passenger locomotives which were delivered last year per "Henley." The several reports sent us have received careful consideration.

In contracting for these locomotives the Commissioners desired to obtain engines adapted to unusually heavy service. In order to secure the utmost efficiency, and to obtain the best results of American experience, they left many of the details of the specification to our judgment. The material for the driving, truck, and tender axles was left optional, and as, in our opinion, the most satisfactory results are usually obtained from axles carefully forged from selected scrap-iron, we ordered such axles from the manufacturer whose product we had been largely using with good results, and whose reputation for excellent work is generally recognised. No test was prescribed by us, as it is well known that no test of scrap axles is conclusive. We relied upon their showing clean, uniform, well-worked material when turned up in the lathe. Steel axles, or axles forged from muck-bars, can be tested under a drop with reasonable probability of the uniformity of the axles not tested; but the fact that a hammered scrap axle withstands such test is no guarantee that others of similar manufacture and appearance will stand. Not only have we been buying axles in this way for many years, but, so far as we know, it is the general practice in buying hammered scrap axles, both by railroads and manufacturers. These axle forgings did turn up clean, smooth, and free from flaws, and we supposed them to be as good as the many hundreds which we had received from the same maker without one instance of failure coming to our knowledge. We go into the matter at this length to assure you that there was no conscious lack of diligence exercised by us to supply materials of the best quality, which your Government was entitled to receive from us.

We have already replaced the twenty-four engine truck-axles with others of steel. We offer to reimburse the Government the cost of replacing the forty-eight tender axles. We also offer to pay the reasonable cost of the labour involved in effecting the replacement.

We are of the opinion that the original dimensions of the truck and tender axles and journal bearings are ample for the fast speed for which the locomotives are suitable, provided the quality of the material is good and the bearings are well lubricated. These dimensions are here considered the best for such engines, and have been widely adopted for similar service with good results. We should have much hesitation in increasing the diameter of the bearings with such small wheels, owing to the higher rotative friction. It should be borne in mind that the smaller truck wheels necessary in engines of this type require closer attention to the lubrication than the larger wheels usual in English locomotives. If, however, larger bearings are adopted, we urge the desirability of making them $5\frac{1}{2}$ inches rather than 6 inches diameter. In view of the above, we think the cost of new boxes, whether of iron or solid gun metal, should not be charged to us, as we are certain that the replacing of the axles will prove a sufficient remedy.

We remark that the driving axles were not made by the same party as the truck and tender axles. We therefore trust they will, upon investigation, prove satisfactory.

There

There appears to have been a clerical error in transmitting to our shopmen the dimensions of draw-hooks shown by your drawings. We authorise you to debit our account the cost of replacing them with stronger hooks.

With these modifications we trust the engines will speedily show the special adaptation, which we believe they possess, to the difficult service for which they were ordered. That similar engines are doing such work on our American railways is shown by the recent tests of our ten-wheel locomotives on the Baltimore and Ohio Railroad. Under separate cover we mail you three copies of the report of these tests. We trust these tests will, in a measure, justify the wisdom of the Commissioners in the purchase of these locomotives, and that after the defective axles are replaced, the performance of the locomotives will be such as to merit their entire approval.

Very truly yours,

BURNHAM, WILLIAMS, & CO.

Baldwin Locomotive Works, Philadelphia, 24 March, 1892.

Mr. H. M'Lachlan, Secretary, Government Railways of New South Wales, Sydney, N.S.W.,—

Dear Sir,

Your favour of the 13th ultimo is to hand this day informing us of the expenses, amounting to £615 7s. 4d., for alterations to bogie axles, axle-boxes, wheel-bosses, and replacing condemned axles on tenders of the locomotives last supplied by us to your railways. In reply, we beg to say that we have given our agents, Messrs. R. Towns & Co., full authority to make such settlement of this claim as may appear to you and them to be equitable. We have no doubt they will adjust the matter to your satisfaction.

Very truly yours,

BURNHAM, WILLIAMS, & CO.

Dear Sirs,

Sydney, 4 March, 1892.

In accordance with the promise made at the interview on the 26th ultimo, I beg to enclose herewith for your information a copy of the notes of the proceedings.

Yours faithfully,

Messrs. R. Towns & Co., Sydney,

H. McLACHLAN,

Secretary.

Dear Sir,

Sydney, 7 March, 1892.

We have the honor to acknowledge receipt of your letter of 4th instant, with copy of notes of the proceedings of interview on 26th ultimo.

Mr. Stokes has perused the same, and would wish that what Mr. Rhodes said in reference to the arrangement proposed by Mr. Thow for supporting the reversing gear be inserted, viz.:—"That as this would be an alteration of design he could not express an opinion, and desired that it should be referred to the Baldwin Company."

Mr. Thow then promised to furnish full particulars of his proposed alterations, to be sent to the Baldwin Company, and he has since done so.

Mr. Stokes and Mr. Rhodes understood that, save this matter, the settlement arrived at was a final one, and that should anything crop up in connection with the engines which, in the opinion of the Commissioners, ought to be borne by the Baldwin Company, the same would be referred to them, Mr. Rhodes having to leave for New Zealand, *en route* to America.

We have, &c.,

H. McLachlan, Esq., Secretary, New South Wales Railways.

R. TOWNS & CO.

Dear Sirs,

New South Wales Government Railways, Sydney, 9 March, 1892.

I have to acknowledge your letter of the 7th instant, respecting copy of notes of interview, and have to say that the Commissioners have no objection to the insertion of the clause quoted by you, and attached you will find slip embodying the same, which will replace the paragraph at bottom of page 2 of the notes.

Yours, &c.,

Messrs. R. Towns & Co., Sydney.

H. McLACHLAN,

Secretary.

Office of the Railway Commissioners of New South Wales,

Sydney, 26 February, 1892.

NOTES of interview relative to Baldwin Locomotives.

Present:

The RAILWAY COMMISSIONERS.

MR. THOW.

MR. RHODES (BALDWIN Co.)

MR. STOKES (TOWNS & Co.)

A STATEMENT showing the whole of the expenditure which has been incurred in connection with the 32 engines purchased from the Baldwin Co., by the Railway Commissioners, since they have commenced working, was submitted by Mr. Thow, and the following items were agreed as being properly chargeable to the Baldwin Co., and it was understood that the amounts not already deducted from the retention money should be deducted.

On account of 12 Passenger engines:—					£	s.	d.
Repairs to portion of brake gear of engine No. 448	...	...	...	...	1	6	0
Fitting reversing screw catches to 12 engines	...	...	...	...	43	19	7
Fitting Westinghouse brake (finishing incomplete brake fitting)	...	...	...	...	6	2	11
Carrying out finishing work on buffers, &c.	...	...	...	...	38	2	11
Repairing or replacing damaged parts	...	...	...	...	123	2	5
Strengthening all reversing lever pins	...	...	...	...	5	4	0
Cost of fitting new bogie brass and turning up tires of bogie wheels of engine 451	...	...	...	...	8	15	6

(Has been deducted) £226 13 4

On

On account of 12 engines, yet to be charged :—						£	s.	d.
Replacing draw-hooks on 12 engines and tenders	...	...	...	...	...	22	4	6
Making 12 wrenches, 1 for each engine	...	...	...	...	...	0	14	7
* One moiety of cost of testing axles...	...	...	...	...	...	16	19	3
On account of 20 Consolidation engines :—								
Fixing catches to reversing screws, putting new fulcrum pins in reversing screw bracket	...	...	...	...	...	62	8	0
Fitting buffers on engines and tenders	...	...	...	...	...	10	16	0
Replacing draw-hooks on tenders and engines	...	...	...	...	...	34	10	0
Finishing incomplete brake fittings	...	...	...	...	...	16	1	8
Making 40 bars 3 ft. 6in. long to fit sockets of screwjacks (jack-bars)	...	...	...	...	...	5	3	3
Finishing work not completed	...	...	...	...	...	23	10	4
The following alterations are not yet completed and a further debit will be made for the work still to be done, as well as whatever is necessary to complete :—								
Alteration to bogie axle, axle-box, and bogie wheel-boss (changing axles, &c.) (12 engines)	...	...	...	...	...	626	2	4
Alterations to axle-box brass and shoe (32 tenders)	...	...	...	...	...	21	14	4
Replacing condemned axles	...	...	...	...	...	168	14	2
Total to be deducted to date	...	...	...	...	...	£1,008	18	5
Amount previously deducted, as above	...	...	...	...	...	226	13	4
Total amount chargeable to Baldwin Co. to date	...	...	...	...	...	£1,235	11	9

On account of 12 Passenger engines :—								
Testing 1 broken axle of engine No. 457	...	...	...	...	...	15	16	0
Breaking 2 axles and preparing pieces for University test (6 axles tested altogether)	...	...	...	...	...	18	2	6
						£33	18	6

The Commissioners decided that the following items, in addition to £16 19s. 3d., being one moiety of cost of testing axles before referred to, should be paid for by the Department, as they were details necessary for the working of the Department, and quite outside the work required from engine builders, unless specially ordered, and a special allowance made for the carrying out of the work.

Complete or Incomplete.	Particulars of Work.	Engines dealt with.	Cost.
Complete.....	Fitting lamps and irons, also coal boards.....	20 Consolidated..	£ s. d. 34 10 10
Incomplete.....	Fitting 1 additional water guage, and carrying main air-pipe to front	"	81 6 5
Complete.....	Repairing 1 tender bogie hook, 2 diagonal stays, and arm of tender brake shaft	"	27 14 4
"	Fitting hand-rails to tenders, and making 20 wrenches for oil-cups	"	38 2 3
"	Fixing 2 foot-boards on each engine	"	22 14 2
Incomplete.....	Alterations to bolt in large end of connecting rods	"	1 10 6
Complete.....	Fixing hand-rails in front of tenders	12 Passenger ...	32 1 3
"	Fixing coal boards to tender	"	4 14 10
Incomplete.....	Shield-plate for fire door-rings	32 Engines	10 1 2
"	Making frames for notices in cabs	"	2 10 5
Complete.....	Making and fitting strainers in man-holes of tanks	"	32 11 9
Incomplete.....	Alterations to brake shoes	20 Consolidated..	2 18 11
"	Alterations to brake shoes	12 Passenger ...	3 9 5
"	Alterations to reversing gear	32 Engines	0 5 4
"	Alterations to tender brake shoes.....	" .....	.....

The arrangement for supporting the reversing screws was discussed, as in the opinion of Mr. Thow the strengthening was absolutely necessary, but at the present moment the details of the arrangement had not been fully worked out.

It was intimated that the Commissioners considered the Baldwin Company should bear the cost of this, and Mr. Rhodes said that as this would be an alteration of design he could not express an opinion, and desired that it should be referred to the Baldwin Company.

It was intimated that should any further weaknesses develop themselves which, in the opinion of the Commissioners, were defects in material, or should have been provided against by the Baldwin Company, the cost of making such alteration would be deducted from the retention money.

With regard to the axles which were sent by the Baldwin Company to replace the defective axles in the bogies of the engines, it was understood that no debit whatever should be made against the Railway Commissioners on account of these axles.

E.M.G.E.
W.M.F.
C.O.

Government Railways of New South Wales, Secretary's Office, Sydney, 22 September, 1890.

Dear Sir,

I send you copy of further letter to Towns & Co. (for the Baldwin Co. of America), ordering twelve locomotives from that firm, to be supplied in five months.

The letters already sent fully explain the steps we have taken, and you will notice in the present communication our requirements are fully stated. No provision, however, has been made with regard to the inspection of the engines; but, if you deem it desirable that the engines should be inspected, the Commissioners will be glad if you will arrange for the appointment of a suitable man, and pay whatever remuneration you may deem right for such services. No doubt leading local engineers would be glad to advise you as to the merits of suitable gentlemen, and you could arrange with Messrs. R. W. Cameron & Co. as to payment of an inspecting engineer's salary.

Yours faithfully,

H. McLACHLAN,

W. Thow, Esq., care Agent-General N.S.W., Westminster Chambers, London.

Secretary.

Sir,

*The other moiety will be charged to the Railway Department, Messrs. Stokes and Rhodes having urged the Commissioners on the grounds that the tests were unusually severe, and consequently unusually expensive.

Sir,

Chief Mechanical Engineer's Office, Eveleigh, Sydney, 8 December, 1891.

With reference to the subject of our conversation to-day, and your instruction of September 22, 1890, containing the following:—"If you deem it desirable that the engines should be inspected, the Commissioners will be glad if you will arrange for the appointment of a suitable man, and pay whatever remuneration you may deem right for such services,"—

I beg to inform you that, on reaching the States, I visited the Baldwin works on the 20th December following, and after I had ascertained the nature of the contract entered into, as well as the other state of the work, I consulted our agents in New York, and other gentlemen, whose knowledge of rolling stock contracts in America enabled them to advise me with regard to the question which your letter left to my judgment.

It was pointed out to me that the manufacture of locomotives under inspection was only usual when the purchaser furnished his own specifications and designs, and that although an inspector might still be appointed he could not have any useful status under a contract then three months old, which did not recognise his authority, and that any action he could take must of necessity, under such circumstances, be very feeble.

Our agents pointed out that the name of the Baldwin firm was a guarantee that the quality of the work they would send us would be equal to the high class productions which had made their reputation.

From what I heard and saw, I concluded that, except in the event of fraud, which there was no reason to apprehend, any inspector appointed by me would be more likely to relieve the makers of some of the responsibility and onus, which, under the contract, rested upon them, than to assist the Commissioners, and also that the cost of the engines would be increased without securing an equivalent benefit.

W. THOW,

Secretary.

Twenty Goods Engines.

H. M'Lachlan, Esq., Secretary, Government Railways, N.S.W.,—

Re Supply of Locomotives.

Dear Sir,

Sydney, 15 December, 1890.

Referring to our letter of 15th November, on this subject, we have the honor to forward herewith three specifications of consolidation locomotives, Engine No. 5,291, class 10. 38 E, Engine No. 5,292, class 10. 36 E. Engine No. 5,293, class 10. 34 E., which have been forwarded by the Baldwin Locomotive Co., Philadelphia, for the information of the Commissioners.

In reference thereto, the Baldwin Co. write as follows:—"On the 23rd October we received your telegram informing us that the Commissioners for Railways require within the coming year about eighty locomotives, and if we can furnish engines sufficiently powerful for speedy delivery the order will probably be given us. We replied on the same date inquiring of what weight and power the locomotives are needed, as we have built engines weighing upwards of 150,000 lb., exclusive of the tender, and are constructing for the Grand Trunk Railway Decapad tank locomotives weighing in working order about 180,000 lb. or 81 gross tons. We offer to construct and ship the entire eighty engines within six months after receipt of order. We have not yet received your reply to this message, and we presume the delay is due to the difficulty in determining the exact specification upon which to invite our estimate. In order to assist in coming to a decision we enclose specifications of three sizes of consolidation freight locomotives."

Specification 5,291 describes the engine above referred to as weighing in working order upwards of 150,000 lb., with cylinders 22 and 28, boilers, 72 inch diameter, and with a wheel-box no greater than the consolidation locomotives at present in service on your lines. The weight per axle is about 34,000 lb., or somewhat more than the limit fixed for the 10-wheel passenger locomotives ordered. It may be, however, that this excess will not be objectionable, as these locomotives will be used in freight service at a much lower speed than the passenger engines, and therefore the effect of impact upon track and gradients will be much reduced. We enclose a statement of the performance of engines of this class on the Northern Pacific Railroad, on grades of 116 feet per mile, in combination with curves of 573 feet radius. We hereby propose and agree to construct locomotives to this specification for the sum of 19,250 dollars each, delivered on shore at Sydney by steamer.

Specification 5,292 describes lighter engines, with cylinders 21 and 26, and a weight per axle of 30,500 lb., or 2,000 lb. less than the limit fixed for the 10-wheel engines. We hereby propose and agree to construct locomotives to the specification for the sum of 17,750 dollars each, delivered as above.

Specification 5,293 describes engine still lighter, the weight per axle being about 26,400 lb. This is the size of freight engines most generally used in this country, being the standard freight engine of the Pennsylvania Railroad, the New York, Lake Erie and Western, the Boston and Albany, the Richmond and Danville, the Louisville and Nashville, the East Tennessee, Virginia, and Georgia, and many other lines. We offer to construct locomotives to this specification for the sum of 16,750 dollars each, delivered as above.

The wheel-base proposed for the three classes of engines is substantially the same. In all three specifications we have included copper fire-boxes, brass tubes, copper dry pipes, copper stay-bolts at the sides of the fire-box, and crown sheets supported either by crown bars or by iron radial stay-bolts. Steel-tired wheels throughout; Westinghouse automatic brake applied to all the driving and tender wheels; screw hand-brake on driving and tender wheels; buffers, draw-hooks and coupling-rods in accordance with the drawings sent us, and all details throughout in accordance with the most approved American practice, as modified by our correspondence respecting the 10-wheeled engines.

Should the Government decide to place the order with us we offer to construct at least twenty locomotives within five months after receipt of order, and to ship the balance in lots of twenty or more, if steamers can be obtained to carry them, at intervals of not more than monthly thereafter. We append memorandum of code words to be used in connection with these specifications.

Errata.—We desire to correct the following clerical error which we have discovered in specification 5,261. Fire-box to be of copper $\frac{1}{2}$ inch thick instead of $\frac{7}{8}$ inch thick.

We have, &c.,

R. TOWNS & CO:

The

The Locomotive Engineer,—

Referring to the subject discussed with the Chairman yesterday, viz., that of providing more powerful engines for goods and live stock traffic over the heavy portion of the line, we have considered the matter, and are of opinion that there is much to be gained in that direction. With heavy gradients on single lines, engines that will take heavy loads at a fair speed, thus reducing the number of trains passing over the line, and shortening the time occupied between stations, is an important consideration. As an instance, we may state that to move 100 trucks of cattle from Dubbo to Penrith seven trains are now run, the speed of which (including all stoppages) averages $13\frac{1}{2}$ miles an hour. Engines are required that will take 33 per cent. greater load, and have a margin of power for increasing the speed to 17 miles an hour. Moreover as there will be shortly on the lines engines capable of hauling forty waggons of cattle from Bourke to Dubbo, assisted possibly for the last 9 miles, to be able to divide such trains into two at Dubbo will greatly facilitate the work. With our existing engines a train of forty trucks of cattle would have to be formed into three trains at Dubbo.

The same advantages, though possibly to a lesser extent, are to be gained on the Northern and Southern systems.

The engine described, viz., having cylinders, 21 inch diameter and 26 inch stroke will, we are satisfied, give such a service, but we would recommend that instead of 50-inch wheels they should be 51 inch, so that the wear of tyres will not bring the wheel diameter below 4 feet.

We would also recommend that the engines and tenders be fitted with the most powerful hand and power brakes, and that the details be specified in accordance with our present practice.

Twelve of these engines will be required to meet the Western live stock traffic alone between Dubbo and Penrith.

D. H. NEALE.
E. A. LOUGHRY.
C. H. STANGER.

20/12/90.

The Secretary—W. THOW (*per* C.A.N.).

Order twelve engines of No. 5,292 type, all details possible to be made interchangeable with the express passenger engines; ordered wheel to be 51-inch diameter. Pressure to be 160 lb. Breaks to be so arranged that only two men required. Early delivery most important.—E.M.G.E., W.M.F., C.O., 22/12/90.

New South Wales Government Railways,

Gentlemen,

Secretary's Office, Sydney, 22 December, 1891.

I am directed by the Railway Commissioners to request you to order from the Baldwin Locomotive Works twelve engines of the specification No. 5,292 type, all details possible to be made interchangeable with the express passenger engines ordered; wheel to be 51 inch diameter; pressure to be 160 lb. Brake to be so arranged that only two men required. Early delivery most important.

Further particulars will follow.

I have, &c.,

H. M'LACHLAN,
Secretary.

Messrs. R. Towns & Co., Sydney.

The Commissioners for Railways, New South Wales,—

Dear Sirs,

Sydney, 23 December, 1890.

We have the honor to acknowledge receipt of your favor of 22nd instant, ordering twelve engines of the specification No. 5,292 type, as sent by the Baldwin Locomotive Works. As requested by you we wired this order and have pleasure to hand you herewith copy of cable sent.

We have, &c.,

R. TOWNS & Co.

Copy of cable sent Baldwin Locomotive Works, 23rd December, 1890, at request of Commissioners for Railways.

Commissioners for Railways, New South Wales.—Order twelve locomotives as per specification No. 5,292; all possible details interchangeable with previous orders; make driving-wheels diameter 51; pressure, 160 lb.; brakes so arranged that only two men required; despatch urgent, sending details.

The Commissioners for Railways, Sydney,

Sydney 29 December, 1890.

Dear Sirs,

In reply to cable to Baldwin Company, conveying your order for twelve locomotives, we have just received following reply:—

"Order entered, shipment May; can construct twenty to twenty-five within same time; this would permit best arrangements possible for shipping. We would advise trial compound system on two or more, 750 dollars each extra."

Should you decide to have twenty to twenty-five, shipped and to try the compound system, please be good enough to instruct us accordingly.

We have, &c.,

R. TOWNS & CO.

Increase the order to twenty, compound two; care to be taken not to exceed outside measurements already given. Inform Thow.—E.M.G.E., W.M.F., 29 12/90.

Dear Sirs,

Sydney, 29 December, 1890.

We are in receipt of your memo. to increase order for locomotives to twenty, two to be compounded, and care to be taken not to exceed outside measurements already given. We immediately, on receiving this, sent the following cable to the Baldwin Company:—

"Commissioners for Railways, New South Wales. Increase order to twenty; compound two, not increasing outside measurements. Inform Thow."

Yours, &c.,

The Commissioners for Railways, Sydney.

R. TOWNS & CO.

New South Wales Government Railways,

Gentlemen,

Secretary's Office, Sydney, 8 January, 1891.

I beg to confirm cablegram forwarded you through Messrs. R. Towns & Co. on the 29th ultimo, increasing the order for twelve goods engines, No. 5,292 specification, to twenty, two of the engines to be compounded, and care to be taken that the outside dimensions do not exceed the measurements already given, and asking that Mr. Thow might be advised.

I have, &c.,

H. M'LACHLAN,
Secretary.

The Baldwin Locomotive Company, Philadelphia, Pa., U.S.A.

(Form 186.)

BALDWIN LOCOMOTIVE WORKS,

BURNHAM, PARRY, WILLIAMS, & CO.,

PHILADELPHIA, P.A., U.S.A.

No. 5433.

CLASS 10-36 D. 9 to 20.

SPECIFICATION

OF A

LOCOMOTIVE ENGINE

FOR THE

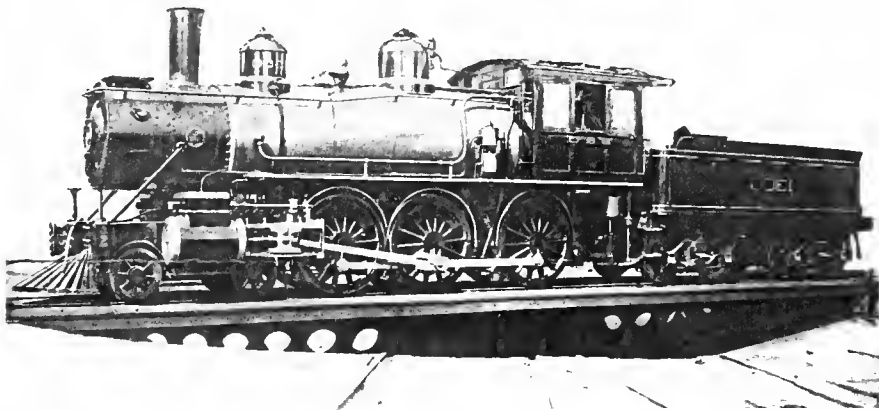
GOVERNMENT OF NEW SOUTH WALES.

JAN. 17, 1891.

GENERAL DESCRIPTION.

General design, illustrated by attached photograph, of Engine 1300, with straight boiler.

Design.



DIMENSIONS.

Specification of Passenger Engines.

BALDWIN LOCOMOTIVE WORKS, BURNHAM, PARRY, WILLIAMS, AND CO., PHILADELPHIA, PA., U.S.A.
(No. 5433.) (Class 10-36, D 9 to 20.)

SPECIFICATION of a locomotive engine for the Government of New South Wales, Jan. 17, 1891.

General Description.

General design illustrated by attached photograph of engine 1300, with straight boiler.

Design.

Dimensions.

Gauge of road, 4 feet 8½ inches in the clear between the rails. Gauge.
Extreme width not to exceed 9 feet 6 inches; across-cab, 9 feet 3 inches across cylinders; extreme Limitations.
height not to exceed 13 feet 6 inches; sharpest curve, 528 feet radius; maximum grade, 176 feet per mile.
Diameter of cylinders, 21 inches; length of stroke, 24 inches. Cylinders.
Weight of engine, empty, about 112,000 pounds; with water and fuel, about 130,000 pounds; Weight of engine.
total weight on driving-wheels, in running order, about 97,500 pounds; weight on engine truck, in running
order, about 32,000 pounds; 32,500 pounds per axle.
Weight of tender, empty, about 33,000 pounds; with full load of fuel and water, about 72,000 pounds. Weight of tender.
Diameter of driving-wheels, 61 inches. Driving-wheels.
Total wheel-base of engine, 23 feet 4 inches; rigid wheel-base, 12 feet 6 inches; spread of engine Wheel-base.
truck-wheels, 6 feet; distance from centre of truck to centre of front driving-wheels, 7 feet 10 inches;
centre of front driving-wheels to centre of second pair of driving-wheels, 5 feet 6 inches; centre of second
to centre of third pair of driving-wheels, 7 feet.
Springs throughout to be of best crucible cast-steel, carefully made and of proper proportions; to Springs.
be carefully tested before being applied. All pins to be case-hardened.
The fuel will be bituminous coal. Fuel.

The Boiler.

The shell of boiler to be of best homogeneous cast-steel, of flange quality, ⅝ inch thick; riveted Material.
with 1-inch rivets, placed not more than 3¼ inches from centre to centre for double riveting, and not more
than 2¼ inches from centre to centre for single riveting. Seams of connecting sheets double riveted;
longitudinal seams, butt-jointed, with double covering strips. Flue-sheet, at smoke-box end, of steel, Heating surface—
half-inch thick. Throat-sheet ½ of an inch thicker than shell of boiler, to prevent undue thin- Tubes . . . 1,821½ sq. in.
ning where flanged. All parts well and thoroughly stayed, and extra welt-pieces riveted to inside of side- Fire-box . . . 105 sq. in.
sheets, providing double thickness of metal for studs of expansion-braces. All plates planed at edges Total . . 1,926½ sq. in.
with round-pointed caulking-tool, insuring plates against injury by chipping and caulking with sharp-
edged tools. Working steam-pressure, 160 pounds per square inch; boiler tested with hot water to a
pressure of 200 pounds per square inch, and with steam to a pressure of 180 pounds per square inch.

Waist, 62 inches diameter at smoke-box end; made straight top, with one dome placed centrally. Waist.
Dome to be made of best homogeneous cast-steel, ½ inch thick, 31½ inches diameter, 30½ inches Dome.
high, and flanged at bottom; to be fitted to boiler by flanging upward the waist-sheet on which dome rests,
and flanging outward the bottom of dome to fit the flange of waist-sheet, the two flanges being riveted
together by one row of horizontal and one row of vertical rivets.

Fire-box to be of best copper, ⅝ inch thick; flue-sheet, ⅝ and ¾ inch thick; crown-sheet of copper, Fire-box,
⅝ inch thick; all plates to be thoroughly annealed after flanging; fire-box to be 120 inches long by 33½
inches wide, by 73 F inches deep inside.

Stay-bolts of copper 1 inch diameter and 4 inches apart; the bolts to be screwed into plates Stay-bolts.
with fine threaded screw and both ends carefully riveted. Water space, 3 inches sides and back, 4 inches
front.

Crown supported by iron radial stay-bolts, 1 inch diameter, not more than 4 inches from centre Crown-staying.
to centre, screwed through crown-sheet and roof of boiler and riveted over.

Brass plug, with fusible centre, to be inserted in crown of fire-box.

Fire-brick arch supported by studs, tapped into side-sheets of fire-box.

Fire-door (oval) to be made of cast-iron, sliding, with cast-iron liner; fire-door opening formed by Fire-brick arch.
flanging and riveting together the inner and outer sheets. Tool guard to be cast on lower part of fire- Fire-box door.
door frame.

Grate-bars of cast-iron; of design adapted to fuel, to be properly fitted and arranged.

Ash-pan of iron, No. 8 wire-gauge, to be properly secured to bottom of fire-box; bottom to be Grate bars.
12 inches clear of grate. Ash-pan.

Damper to be placed at each end of ash-pan, to be worked from foot-board; each damper when Dampers.
shut to keep itself well closed by its own weight.

Mud-holes, for cleaning, to be made in the legs of the boiler at bottom, one in each corner, 2 Mud-holes.
inches diameter, and one under waist in front end, below the tubes, 2½ inches diameter, all with brass
plugs screwed in; two cleaning-plugs 2½ inches diameter on right side, and one on left side level with
crown-sheet.

Flues to be made of brass, Nos. 12 and 14 wire-gauge; 270 in number, 2 inches diameter, 13 feet Flues.
long; to be fitted at fire-box end with steel thimbles, and carefully expanded and beaded over both flue
sheets.

Balanced poppet throttle-valve or regulator to be fitted in dome to vertical arm of dry-pipe and Regulator or throttle.
worked by rod and handle from the foot-plate.

Steam-pipes, main and branch, leading from dome to cylinders; main or dry-pipe of copper, Steam-pipes.
½ inch thick, inside 7½ inches diameter; branch pipes, of cast-iron, accurately fitted with ground-joints
and brass rings.

The smoke-box to be round, and extended, with netting, deflecting plate and spark ejector; smoke- Smoke-box.
box front of cast-iron; the door to be in one piece, to open horizontally; to be fastened by outside tap-
bolts, fitted so that they will draw the door to a close joint.

Smoke-stack of iron, taper pattern; to be perfectly and strongly fitted to smoke-box; top to be Smoke-stack,
not more than 18 feet 6 inches above top of rails.

*Machinery***Cylinders.**

Cylinders to be outside-connected, of close-grained iron as hard as can be worked; each cylinder cast in one piece with half saddle, placed horizontally; right and left hand cylinders reversible and interchangeable; accurately planed, fitted, and bolted together in the most approved manner. Valve-face and steam-chest seat raised above face of cylinder to allow for wear. Cylinders and valves oiled by Nathan 8-automatic sight feed lubricator, placed in cab, connected to steam-chests by copper-pipes running under jacket. Pipes proved to 200 pounds pressure. Cylinders to be 22 inches inside diameter; stroke to be 24 inches; cylinder-covers to have ground-joints; steam-ports to be 19 inches by $1\frac{1}{2}$ inches; exhaust-ports to 19 inches by 3 inches.

Cylinder-cocks.

Cylinder-cocks to be fitted to cylinders; to be operated from foot-board.

Pistons.

Piston-heads of cast-iron, fitted with approved form of steam-packing; piston-rods of iron or steel, ground and keyed to cross-heads, and securely fastened to pistons.

Exhaust-pipes.

Exhaust-pipes to be of cast-iron, with three different sizes of nozzles, of suitable capacity.

Steam jet or blower.

Cock and pipe to be fitted to boiler to turn a jet of steam up the chimney when required; to be worked from foot-board.

Steam-joints

All steam-joints to be metal to metal when finished.

Cross-heads.

Cross-heads to be made of cast-steel, with brass-bearings; wrist-pins to be 4 inches diameter and $3\frac{1}{2}$ inches long. Stub solid as P.R.R., except-wedge vertical.

Guides.

Guides to be of steel, cast-iron, or wrought-iron case-hardened, fitted to wrought-iron guide yoke.

Valve-motion

Shifting link-motion, graduated to cut off equally at all points of the stroke. Links, sliding-blocks, pins, lifting-links, and eccentric-rod jaws made of hammered iron, well case-hardened. Sliding-blocks with long flanges to give ample wearing surface. Rock-shaft of wrought-iron; reverse-shaft of wrought-iron with arms forged on. Weight of links and eccentric-rods counterbalanced by a spring. Slide-valves, balanced pattern, with vacuum-valves; valve-stems to clasp valves. No screws or joints inside of steam-chests.

Packing.

U.S. metallic packing for piston-rod and valve-stems.

Screw reverse-gear.

Rods.**MAIN STUBS**

Connecting and parallel rods of steel, or hammered iron, forged solid. Connecting-rods with main stubs, keys, and brasses, but without straps. Parallel-rods with straps, keys, and brasses, or with solid ends and heavy brass bushings. Bushings put in by hydraulic pressure and well secured from turning in rod.

Crank-pins (large).

Crank-pins of steel or wrought-iron, of proper size, accurately turned and fitted with care.

Oil-cups.

Lubrication of all bearings carefully provided for and oil-cups attached where required. Wick, spindle, or adjustable needle oil-cups on rods and guides.

Feed-water.

Supplied by two 10 $\frac{1}{2}$ -Sellers' 1887 injectors, valves and cages of best hard brass, accurately fitted; cock in feed-pipe regulated from foot-board; all pipes, feed, steam, and check, of copper.

Safety-valves.

Three safety-valves to be placed on the dome; to be set to blow off at a pressure of 160 pounds per square inch; safety-valves to be furnished with relief lever, one with cap and lock.

Steam-gauge.

Steam-gauge of approved make, after being tested, to be fitted on top of boiler, inside of cab.

Glass water-gauge.

One glass water-gauge to be fitted to boiler, in cab, with brass cocks and guard-case of polished iron; gauge to be of Scotch annealed glass.

Gauge-cock.

Three gauge-cocks, to be finished and fitted to face of boiler, with drip-funnel of brass.

Slow-off cock.

Blow-off cock of brass, to be fitted in fire-box at bottom; to be worked from foot-board.

*Frames and Running-gear.***Engine-frames.**

Frames of hammered iron, made in two sections, so as to be taken apart in or near the middle, for convenience of repairs or shipping. From rails bolted and keyed to main frames, with front and back lugs forged on for cylinder connections. Pedestals forged solid with main frame and protected from wear of boxes by cast-iron gibs and wedges. Pedestal-caps lugged and bolted to bottom of pedestals.

Boiler-braces.

Waist of boiler securely braced to frames between fire-box and smoke-box by T-irons fitted to boiler and bolted to wrought-iron plates extending across.

Expansion room.

Proper allowance for difference of expansion of boiler and frame to be made where frame is attached to boiler at fire-box end.

*Driving-wheels.***Driving-wheels.**

Six in number, 61 inches in diameter. Centres of wrought-iron, turned to 55 inches diameter and carefully counterbalanced.

Tires.

Of cast-steel, of Standard Steel Works' make, 3 inches thick when finished; front and back pairs flanged, $5\frac{1}{2}$ inches wide, main pair plain, 6 wide.

AXLES PREFERRED**THUS****Driving-boxes.**

Of hammered iron or steel; journals 8 inches diameter and $8\frac{1}{2}$ inches long; to be made a true cylinder and carefully fitted.

Lubricators as specified by Mr. Thow.

Driving-boxes of steeled cast-iron, planed true on all sides, and slotted to the bearings, which are to be turned and truly fitted; the upper bearings to have oil-box and cover and grooved diagonally on the inside; the lower part to have a sponge-box cast in it and to be supported by two bolts, easily removable for examination of bearings and journals; the boxes to be provided with wedges on one side to take up the wear.

*Engine-truck.***Plan.**

Centre-bearing swivelling, 4-wheeled truck. Truck-frame of wrought or cast-iron, with braces of wrought iron; fitted with swinging bolster, or with fixed centre-bearing.

Wheels.

Four cast-iron centre steel-tired wheels, 30 inches diameter. Axles of hammered iron or steel, with journals 5 inches diameter and 10 inches long.

Springs.

Of crucible cast-steel, tempered in oil; connected by equalising beams resting on tops of boxes.

*Equalisation.***Equalisation.**

The weight of the locomotive to be distributed upon the wheels by equalising-levers, connecting to the springs and properly designed to give each wheel perfect bearing on the track under all conditions of service.

Accessories.

Accessories.

Substantially built of clear, sound ash, or clear pine, well seasoned and finished, and properly painted and varnished. Cab to be fitted together with joint-bolts and corner plates and firmly secured to boiler. To be provided with suitable windows and doors, conveniently arranged, and glazed with first-quality double American crystal glass. Doors to open on hinges and provided with strong fastenings to secure them shut or open at any distance. Roof to be covered with tin, properly put on, and painted. Cab made so that it can be taken to pieces to facilitate shipping.

Running-boards of iron, with nosings of iron, polished or painted.

Running-boards.

Hand-rails of polished brass, or of iron, polished or painted. Wheel-cover nosings of polished brass, or of iron, polished or painted. Hand-rails and wheel covers.

Cylinders lagged with wood and neatly cased with iron, painted. Cylinder-head covers of hydraulic forged steel or cast-iron, painted or polished. Steam-chests with cast-iron tops; bodies cased with iron, painted. Dome lagged with asbestos or magnesia, with iron, painted, casing on body, and cast iron top and bottom rings. Boiler lagged with asbestos or magnesia, neatly jacketed with planished iron, secured by brass or iron bands.

Screw hand-brakes and Westinghouse automatic air-brake on all driving and tender-wheels. Ross modified shoes. Brakes.

Pilot of iron, strongly braced with iron, arranged to suit buffers.

Pilot.

Draw-bar of wrought-iron, strongly fastened to centre of forward buffer beam.

Drawn-bar.

Engine and tender fitted with spring buffers and draw-hook, latter to withstand breaking strain of at least 100,000 lb. Turton buffers same as furnished Beyer, Peacock, and Company. Buffers and couplings.

Each locomotive shall be erected complete at the works of the builder, and a trial under steam be made sufficient to show that it is in perfect working order, and that proper clearances and adjustments have been provided. Testing.

Engine and tender to be properly painted; to be neatly striped when required; to be varnished with three coats of best varnish. Painting.

Engine to be furnished with front and back sand-boxes, but not on boiler, gong, whistle, cab-seats, and cab-seat cushions. Furniture and tools.

To be provided with a complete set of wrenches to fit all nuts and bolts, including one large and one small monkey-wrench; six files, assorted; one gauge-lamp and holder; one brass torch; three iron and six wood tube plugs; one tube-plug holder; six cast-steel chisels, assorted; two pin-punches; one chipping hammer; one soft hammer; one copper tallow-kettle; one copper tallow-bucket; one brass oil-can; two oil-feeders; two galvanised buckets; one pick; one slice-bar; one rake; one fire-shovel; and two screw traversing jacks. Cab tool-boxes with locks and keys.

To be carefully taken apart and boxed ready for shipment. All the bright work, such as connecting rods, pistons, straps, eccentrics, guides, cross-heads, cylinder-covers, bolts, &c., to be well covered with and protected from oxidation by a mixture of tallow, beeswax, and white lead put on while warm; these parts to be then packed in boxes and securely braced, and not packed with shavings, hay straw, or any similar material. The bright work that cannot be boxed, such as crank pins, journals of axles and eccentrics, to be coated same as other bright work, then wrapped with stout canvas tied on and tarred. Packing-boxes to be made of suitable material and strongly hooped with iron.

Packing-list, in duplicate, to be made by builders, showing weight and measurement, together with names and numbers of boxes, bundles and pieces. A drawing to be furnished for guidance in re-erecting the engine. Packing-list.

General Features of Construction.

All principal parts of engine accurately fitted to gauges and templates, and thoroughly interchangeable. Gauges.

All finished movable nuts and all wearing surfaces of machinery of steel, or iron, case-hardened.

Case-hardening.

All threads on bolts to United States standard; such bolts as require them to have jam-nuts.

Alloy.

Tender.

Tank of steel or iron, strongly put together, with angle iron corners and well braced. Top, inside, and bottom plates $\frac{1}{4}$ inch thick; outside plates $\frac{3}{8}$ inch thick; riveted with $\frac{3}{8}$ inch rivets, $1\frac{1}{2}$ inch pitch.

Capacity 3,600 gallons (of 231 cubic inches). Shape of tank wedge, square top.

Capacity.

Tender-frame substantially built of channel iron, strongly braced. Tender floor to be of wrought-iron plates, $\frac{1}{4}$ inch thick. Frame.

Two 4-wheeled centre-bearing trucks; additional bearings at sides of back truck. Pattern of truck, square wrought-iron frames equalised. Trucks.

Springs of crucible cast-steel, tempered in oil.

Springs.

Wheels, cast-iron centres with steel tires, 36 inches diameter.

Wheels.

Axles of hammered iron or steel; journals 4 inches diameter by 8 inches long, $5\frac{1}{4}$ " wheel fit.

Axles and journals

Oil-tight boxes with brass bearings, accurately finished and fitted.

Journal-boxes.

Brakes on both trucks, operated by suitable brake-shaft at forward end of tender.

Brakes.

Tank-valves, with strainers conveniently arranged in front end of tank at bottom to connect with feed pipes, and worked from foot-board by levers at top of tank. Tank-valves.

Tender connected with engine by India-rubber hose, one on each side, of best quality and proper size. Hose-connections.

Two safety-chains to connect tender with engine; also two for each truck, connecting front corners of trucks with tank-frame. Safety-chains.

Two tool-boxes of iron, strongly made, with good locks, and strong strap hinges; to be placed on top of tender. Tool-boxes.

Particular care to be taken that all bearings of importance have good oil cups or cellars capable of holding a proper worsted syphon or other efficient means of feeding oil. Lubrication.

All oil cups should have proper covers, well secured, and dust-proof, as our line is very dusty and hot bearings very common.

Especial care to be taken with boiler, frame, and rod work.

Workmanship.

Tire section as tracing 2090.

BALDWIN

BALDWIN LOCOMOTIVE WORKS.

Physical Test of Materials.

All materials used in the construction of the locomotive shall be of the best quality of their respective kinds, carefully inspected, and subjected to the following tests. Notwithstanding these tests, should any defects be developed in working the corresponding part will be rejected.

Boiler iron.

All boiler iron will be specified C. H. No. 1 Flange quality, and must be made from the best charcoal blooms.

A careful examination will be made of every sheet, and none will be accepted that show mechanical defects.

A piece for testing to be furnished from each sheet.

A test piece to be furnished from each sheet, to be tested. Such test strips must show an ultimate tensile strength with the grain of not less than 50,000 pounds, an ultimate tensile strength across the grain of not less than 45,000 pounds, and must show a ductility, measured by elongation, of not less than 20 per cent. Should any of the test pieces fail to fulfil the above requirements, the corresponding sheet will be rejected.

Should any plates develop defects in working, they will be rejected.

Each plate must be stamped with the maker's name and the guaranteed tensile strength and elongation as above.

Boiler and fire-box steel.

A careful examination will be made of every sheet, and none will be accepted that show mechanical defects.

Test strips taken lengthwise from each sheet and without annealing should have a tensile strength of 55,000 pounds per square inch, and an elongation of 30 per cent., in section originally 2 inches long.

Sheets will not be accepted if the test shows a tensile strength less than 50,000 pounds, or greater than 65,000 pounds per square inch, nor if the elongation falls below 25 per cent.

Should any sheets develop defects in working they will be rejected.

Fire-box copper.

Copper plates for fire-boxes must be rolled from best quality Lake Superior ingots; they must have a tensile strength of not less than 30,000 pounds per square inch, and an elongation of from 20 to 25 per cent., in section originally 2 inches long. Test strips must be furnished with each fire-box for testing.

Iron and steel stay-bolts and boiler braces.

Iron or steel for stay-bolts and braces must have an ultimate tensile strength of not more than 60,000 pounds nor less than 50,000 pounds per square inch, with an elongation of not less than 30 per cent., nor undergo a reduction of area of fractured section of more than 35 per cent.

Copper stay-bolts.

Copper stay-bolts must be manufactured from the best Lake Superior ingots; they must have an ultimate tensile strength of not less than 30,000 pounds per square inch, and an elongation of from 20 to 25 per cent., in section originally 2 inches long.

Boiler-tubes of steel or iron.

All boiler tubes must be carefully inspected and be free from pit-holes or other imperfections. Each tube must be subjected to an internal hydraulic pressure of not less than 500 pounds per square inch by the manufacturers before delivery. They must be rolled accurately to the gauge furnished by the Baldwin Locomotive Works, filling the gauge to a plump fit. They must be expanded in the boiler without crack or flaw.

When tested, iron or steel tubes must show a tensile strength of not less than 55,000 pounds per square inch, and a ductility of not less than 15 per cent.

Boiler-tubes of brass or copper, brass and copper pipes.

Tubes of brass or copper to be of uniform circumferential thickness and solid drawn; to be perfectly round, and to resist an internal hydraulic pressure of 300 pounds per square inch. From the tubes under test, a piece 4 inches long will be cut, annealed, sawn lengthwise, and doubled inside out without showing sign of cracks.

When annealed they must withstand flanging cold a flange $\frac{5}{8}$ of an inch broad for 2-inch tubes without cracking. Copper tubes must withstand flanging hot as well as cold. Tubes other sizes than 2 inches diameter must flange to a width proportional to their diameter.

A piece 30 inches long, annealed and filled with rosin, must withstand being doubled until the extremities touch each other without showing defects.

A piece 30 inches long, not annealed, filled with rosin, and placed on supports 20 inches apart, must withstand bending to a deflection of 3 inches without showing defects.

Bar iron.

Bar iron should have a tensile strength of 50,000 pounds per square inch, and an elongation of 20 per cent., in section originally 2 inches long. Iron will not be accepted if tensile strength falls below 48,000 pounds, nor if elongation is less than 15 per cent., nor if it shows a granular fracture.

Chilled wheels.

Of approved make, and of following guaranteed mileage:—

For 28" wheels...	... 40,000 miles.	For 33" wheels...	... 50,000 miles.
" 30" "	... 45,000 "	Other sizes in proportion.	

(Adopted by Joint Committee of Master Car Builders' Association, American Railway Master Mechanics' Association and Association of Manufacturers of Chilled Car-Wheels, 21st November, 1889.)

Deficient mileage will be adjusted upon return of the defective wheel, or that part of same containing the defect causing withdrawal from service. Or, if preferred, wheels will be furnished subject to approved specification and drop test, without mileage guarantee.

(Form 186.)

BALDWIN LOCOMOTIVE WORKS,
BURNHAM, PARRY, WILLIAMS, & CO.,
PHILADELPHIA, P.A., U.S.A.

No. 5432.

SPECIFICATION

CLASS 10-36 E. 40 to 57.
10 21/38 E. 1 & 2.

OF A

LOCOMOTIVE ENGINE

FOR THE

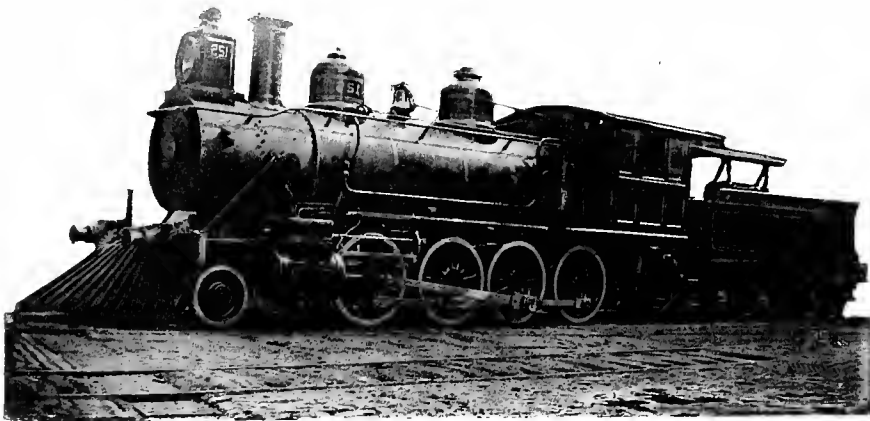
GOVERNMENT OF NEW SOUTH WALES.

JAN. 17, 1891.

GENERAL DESCRIPTION.

General design, illustrated by attached photograph, of Engine DOM PEDRO, 125.

Design



Specification of Consolidation Goods Engines.

BALDWIN LOCOMOTIVE WORKS (BURNHAM, PARRY, WILLIAMS & Co.), PHILADELPHIA, P.A., U.S.A.
(No. 5,432.) (Class 10-36 E. 40 to 57, 10 21/38, E. 1 & 2.)

SPECIFICATION of a Locomotive Engine for the Government of New South Wales, January 17, 1891.

General Description.

General design illustrated by attached photograph of engine Dom Pedro, 125.

Design.

Dimensions.

Gauge of road—4 feet 8½ inches in the clear between the rails. Gauge.
Extreme width not to exceed 9 feet 6 inches; extreme height not to exceed 13 feet 6 inches; 9 feet 3 inches across cylinders; sharpest curve, 528 feet radius; maximum grade, 176 feet per mile. Limitations.
Diameter of cylinders, 21 inches; length of stroke, 26 inches. Cylinders.
Weight of engine, empty, about 118,000 pounds; with water and fuel about 138,000 pounds; total weight on driving-wheels, in running order, about 122,000 pounds; weight on engine truck, in running order, about 16,000 pounds—30,500 per axle. Weight of Engine.
Weight of tender, empty, about 33,000 pounds; with full load of fuel and water about 72,000 pounds. Weight of Tender.
Diameter of driving-wheels, 51 inches. Driving-wheels.
Total wheel-base of engine, 22 feet 4 inches; rigid wheel-base, 14 feet 3 inches; distance from centre of truck to centre of front driving-wheels, 8 feet 1 inch; centre of front driving-wheels to centre of second pair of driving-wheels, 4 feet 11 inches; centre of second to centre of third pair of driving-wheels, 4 feet 6 inches; centre of third to centre of fourth pair of driving-wheels, 4 feet 10 inches. Wheel-base.
Springs throughout to be of the best crucible cast steel, carefully made and of proper proportions; to be carefully tested before being applied. All pins to be case-hardened. Springs.
The fuel will be bituminous coal. Fuel.

The Boiler.

The shell of boiler to be of best homogeneous cast steel, of flange quality, ⅝ inch thick; riveted with 1 inch rivets, placed not more than 3¼ inches from centre to centre for double riveting, and not more than 2¼ inches from centre to centre for single riveting. Seams of connecting sheets double riveted; longitudinal seams butt-jointed with double covering strips. Flue-sheet, at smoke-box end, of steel, half-inch thick. Throat-sheet one-eighth of an inch thicker than shell of boiler, to prevent undue thinning when flanged. All parts well and thoroughly stayed, and extra welt-pieces riveted to inside of side-sheets, providing double thickness of metal for studs of expansion-braces. All plates planed at edges with round-pointed calking-tool, insuring plates against injury by chipping and calking with sharp-edged tools. Working-steam pressure 160 pounds per square inch; boiler tested with hot water to a pressure of 200 pounds per square inch, and with steam to a pressure of 180 pounds per square inch. Material.
Heating Surface—
Tubes .. 1,809 sq. ft.
Fire-box 158 sq. ft.
Total .. 1,967 sq. ft.

Waist 64 inches diameter at smoke-box end; made straight top, with one dome placed centrally. Waist.
Dome to be made of best homogeneous cast steel, ⅝ inch thick, 31½ inches diameter, 30½ inches high, and flanged at bottom; to be fitted to boiler by flanging upward the waist-sheet on which dome rests, and flanging outward the bottom of dome to fit the flange of waist-sheet, the two flanges being riveted together by one row of horizontal and one row of vertical rivets. Dome.

Fire-box to be of best copper, ⅝ inch thick; flue-sheet ⅝ and ⅞ inch thick; crown-sheet of copper, ⅝ inch thick; all plates to be thoroughly annealed after flanging; fire-box to be 112 inches long by 42 inches wide, by 62 F 58 B inches deep inside. Fire-box.

Stay-bolts of copper, one inch diameter, and four inches apart; the bolts to be screwed into plates with fine threaded screws, and both ends carefully riveted. Water space 3 sides and back, 4 inches front. Stay-bolts.

Crown supported by iron radial stay-bolts, one inch diameter, not more than four inches from centre to centre, screwed through crown-sheet and roof of boiler and riveted over.

Brass plug, with fusible centre, to be inserted in crown of fire-box.

Fire-brick arch supported by studs tapped into side-sheets of fire-box.

Fire-door oval to be made of cast iron sliding with cast-iron liner; fire-door opening formed by flanging and riveting together the inner and outer sheets. Tool guard to be cast on lower part of fire-door frame. Fusible plug.
Fire-brick arch.
Fire-box door.

Grate-bars of cast iron, of design adapted to fuel, to be properly fitted and arranged.

Ash-pan of iron, No. 8 wire-gauge, to be properly secured to bottom of fire-box; bottom to be twelve inches clear of grate. Grate-bars.
Ash-pan.

Damper to be placed at each end of ash-pan, to be worked from foot-board; each damper when shut to keep itself well closed by its own weight. Dampers.

Mud-holes, for cleaning, to be made in the legs of the boiler at bottom, one in each corner, two inches diameter, and one under waist in front end, below the tubes, two and one-half inches diameter, all with brass plugs screwed in; two cleaning-plugs two and one-half inches diameter on right side and one on left side level with crown-sheet. Mud-holes.

Flues to be made of brass, No. 12 and 14 wire-gauge; 231 in number, 2¼ inches diameter, 13 feet 4½ inches long; to be fitted at fire-box end with steel thimbles, and carefully expanded and beaded over both flue-sheets. Flues.

Balanced poppet throttle-valve or regulator to be fitted in dome to vertical arm of dry-pipe and worked by rod and handle from the foot-plate. Regulator or throttle.

Steam-pipes, main and branch, leading from dome to cylinders; main or dry-pipe of copper, ⅝ inch thick, inside 7½ inches diameter; branch pipes, of cast iron, accurately fitted with ground-joints and brass rings. Steam-pipes.

The smoke-box to be round, and extended, with netting, deflecting plate, and spark-ejector; smoke-box front of cast iron; the door to be in one piece, to open horizontally; to be fastened by outside tap-bolts, fitted so that they will draw the door to a close joint. Smoke-box.

Smoke-stack of iron, taper pattern; to be perfectly and strongly fitted to smoke-box; top to be not more than 13 feet 6 inches above top of rails. Smoke-stack.

Machinery.

Cylinders.	Cylinders to be outside-connected, of close-grained iron as hard as can be worked; each cylinder cast in one piece, with half saddle placed horizontally; right and left hand cylinders reversible and interchangeable; accurately planed, fitted, and bolted together in the most approved manner. Valve-face and steam-chest seat raised above face of cylinder to allow for wear. Cylinders and valves oiled by Nathan 8 inch automatic sight feed lubricator placed in cab, connected to steam-chests by copper pipes running under jacket. Pipes proved to two hundred pounds pressure. Cylinders to be 21 inches inside diameter; stroke of piston to be 26 inches; cylinder-covers to have ground-joints; steam-ports to be 19 inches by 1½ inch; exhaust-ports to be 19 inches by 8 inches.
Two engines compounded.	
H.P. Cyls. 18½ in. diam.	
L.P. " 22 in. "	
Stroke 26 in. "	
Cylinder cocks.	Cylinder-cocks to be fitted to cylinders; to be operated from foot-board.
Pistons.	Piston-heads of cast iron, fitted with approved form of steam packing; piston-rods of iron or steel, ground and keyed to cross-heads, and securely fastened to pistons.
Exhaust-pipes.	Exhaust-pipes to be of cast iron, with three different sizes of nozzles, of suitable capacity.
Steam jet or blower.	Cock and pipe to be fitted to boiler to turn a jet of steam up the chimney when required; to be worked from foot-board.
Steam-joints.	All steam-joints to be metal to metal when finished.
Cross-heads.	Cross-heads to be made of cast steel, with brass bearings; wrist-pins to be 4 inches diameter, and 3½ inches long.
Guides.	Guides to be of steel, cast iron, or wrought iron case-hardened, fitted to wrought-iron guide yoke.
Valve-motion.	Shifting link-motion, graduated to cut off equally at all points of the stroke. Links, sliding blocks, pins, lifting-links, and eccentric-rod jaws made of hammered iron, well case-hardened. Sliding-blocks with long flanges to give ample wearing surface. Rock shaft of wrought iron; reverse shaft of wrought iron, with arms forged on. Weight of links and eccentric-rods counterbalanced by a spring. Slide-valves balanced pattern with vacuum valves; valve-stems to clasp valves. No screws or joints inside of steam chests. U.S. metallic packing for piston rod and valve stems. Screw reverse gear.
Rods.	Connecting and parallel rods of steam or hammered iron, forged solid. Connecting rods with keys and split brasses. Parallel rods with solid ends and heavy brass bushings. Bushings put in by hydraulic pressure, and well secured from turning in rod. Main rod ends similar to prints 2,088 and 2,089.
Crank-pins.	Crank-pins of steel or wrought iron, of proper size, accurately turned and fitted with care.
Oil-cups.	Lubrication of all bearings carefully provided for, and oil-cups attached where required. Wick, spindle, or adjustable needle oil-cups on rods and guides.
Feed-water	Supplied by two 10½ inch Seller's 1887 injectors, valves and cages of best hard brass, accurately fitted; cock in feed-pipe regulated from foot-board; all pipes, feed, steam, and check, of copper.
Safety-valves.	Three safety-valves to be placed on the dome; to be set to blow off at a pressure of 160 pounds per square inch; two valves to be furnished with relief lever, one with cap and lock.
Steam-gauge.	Steam-gauge of approved make, after being tested, to be fitted on top of boiler, inside of cab.
Glass water-gauge.	One glass water-gauge to be fitted to boiler, in cab, with brass cocks and guard-case of polished iron; gauge to be of Scotch annealed glass.
Gauge-cocks.	Three gauge-cocks to be finished and fitted to face of boiler, with drip-funnel of brass.
Blow-off cock.	Blow-off cock of brass, to be fitted in fire-box at bottom; to be worked from foot-board.

Frames and Running-gear.

Engine-frames.	Frames of hammered iron, made in two sections, so as to be taken apart in or near the middle for convenience of repairs or shipping. Front rails bolted and keyed to main frames, with front and back lugs forged on for cylinder connections. Pedestals forged solid with main frame, and protected from wear of boxes by cast-iron gibs and wedges. Pedestal-caps lugged and bolted to bottom of pedestals.
Boiler-braces.	Waist of boiler securely braced to frames between fire-box and smoke-box by T-irons fitted to boiler and bolted to wrought-iron plates extending across.
Expansion room.	Proper allowance for difference of expansion of boiler and frame to be made where frame is attached to boiler at fire-box end.

Driving-wheels.

Driving-wheels.	Eight in number, 51 inches in diameter. Centres of cast-iron, turned to 45 inches diameter, and carefully counterbalanced.
Tires.	Of cast steel, of Standard Steel Works make, 3 inches thick when finished; front and back pairs flanged, 5½ inches wide, intermediate pairs plain, 6 wide.
Axles.	Of hammered iron or steel; journals 8 inches diameter and 8½ inches long; to be made a true cylinder and carefully fitted.
Driving-boxes.	Driving-boxes of steeled cast iron, planed true on all sides and slotted to the bearings, which are to be turned and truly fitted; the upper bearings to have oil-box and cover and grooved diagonally on the inside: the lower part to have a sponge-box cast in it, and to be supported by two bolts, easily removable for examination of bearings and journals; the boxes to be provided with wedges on one side to take up the wear.
Lubricators as specified by Mr. Thow.	

Engine-Truck.

Plan.	Centre-bearing swivelling two-wheeled truck with radius bar. Truck-frame of wrought or cast iron, with braces of wrought iron; fitted with swinging bolster or with fixed centre-bearing.
Wheels.	Two cast iron centre steel-tired wheels 30 inches diameter. Axles of hammered iron or steel, with journals 5 inches diameter and 10 long.
Springs.	Of crucible cast steel, tempered in oil; connected by equalising beams resting on tops of boxes.

Equalization.

Equalization.	The weight of the locomotive to be distributed upon the wheels by equalizing levers, connecting to the springs and properly designed to give each wheel perfect bearing on the track under all conditions of service.
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Accessories.

Cab.	Substantially built of clear, sound ash, or clear pine, well seasoned and finished, and properly painted and varnished. Cab to be fitted together with joint-bolts and corner plates, and firmly secured to boiler. To be provided with suitable windows and doors, conveniently arranged, and glazed with first-quality
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quality double American crystal glass. Doors to open on hinges and provided with strong fastenings to secure them shut or open at any distance. Roof to be covered with tin, properly put on and painted. Cab made so that it can be taken to pieces to facilitate shipping.

Running-boards of iron, with nosings of iron, polished or painted.

Hand-rails of polished brass, or of iron polished or painted. Wheel-cover nosings of polished brass or of iron polished or painted. Running boards
Hand-rails and wheel-covers.

Cylinders lagged with wood and neatly cased with iron, painted. Cylinder-head covers of hydraulic-forged steel or cast iron, painted or polished. Steam chests with cast-iron tops; bodies cased with iron, painted. Dome lagged with asbestos or magnesia, with iron, painted, casing on body, and cast-iron top and bottom rings. Boiler lagged with asbestos or magnesia, neatly jacketed with planished iron, secured by brass or iron bands. Finish.

Screw hand-brakes and Westinghouse automatic air-brake on all driving and tender wheels. Ross modified shoes. Brakes.

Pilot of iron, strongly braced with iron, arranged to suit buffers.

Draw-bar of wrought iron, strongly fastened to centre of forward buffer beam.

Engine and tender fitted with spring buffers and draw-hook, similar to tracings 2,086 and 2,087. Buffers and couplings

Turton buffers same as furnished Beyer, Peacock, and Co.

Each locomotive shall be erected complete at the works of the builder, and a trial under steam be made sufficient to show that it is in perfect working order, and that proper clearances and adjustments have been provided. Testing.

Engine and tender to be properly painted; to be neatly striped when required; to be varnished with three coats of best varnish. Painting.

Engine to be furnished with front and back sand-boxes, not placed on boiler, gong, whistle, cab-seats, and cab-seat cushions. Furniture and tools.

To be provided with a complete set of wrenches to fit all nuts and bolts, including one large and one small monkey-wrench, six files, assorted; one gauge-lamp and holder, one brass torch, three iron and six wood tube-plugs, one tube-plug holder, six cast-steel chisels, assorted; two pin-punches, one chipping hammer, one soft hammer, one copper tallow-kettle, one copper tallow-bucket, one brass oil-can, two oil-feeders, two galvanised buckets, one pick, one slice-bar, one rake, one fire-shovel, and two screw traversing jacks. Cab tool-boxes with locks and keys.

To be carefully taken apart and boxed ready for shipment. All the bright work, such as connecting-rods, pistons, straps, eccentrics, guides, cross-heads, cylinder-covers, bolts, etc., to be well covered with and protected from oxidation by a mixture of tallow, beeswax, and white-lead put on while warm; these parts to be then packed in boxes and securely braced, and not packed with shavings, hay, straw, or any similar material. The bright work that cannot be boxed, such as crank-pins, journals of axles and eccentrics to be coated same as other bright work, then wrapped with stout canvas, tied on and tarred. Packing-boxes to be made of suitable material and strongly hooped with iron. Packing.

Packing-list, in duplicate, to be made by builders, showing weight and measurement, together with names and number of boxes, bundles, and pieces. A drawing to be furnished for guidance in re-erecting the engine. Packing-list.

General Features of Construction.

All principal parts of engine accurately fitted to gauges and templates, and thoroughly interchangeable. Gauges.

All finished movable nuts and all wearing surfaces of machinery of steel, or iron, case-hardened. Case-hardening.

All threads on bolts to United States standard; such bolts as require them to have jam-nuts. Alloy.

Tender.

Tank of steel or iron, strongly put together, with angle iron corners and well braced. Top, inside and bottom plates $\frac{1}{4}$ inch thick; outside plates $\frac{3}{8}$ inch thick; riveted with three-eighths inch rivets, one and one-quarter inch pitch. Tank.

Capacity: 3,600 gallons (of 231 cubic inches.) Shape of tank: wedge, square-top, same as passenger engines. Capacity.

Tender-frame substantially built of channel iron, strongly braced. Tender-floor to be of wrought-iron plates, one-quarter inch thick. Frame.

Two four-wheeled centre-bearing trucks; additional bearings at sides of back truck. Pattern of Trucks.

truck: square wrought-iron frames, equalized.

Springs, of crucible cast-steel, tempered in oil. Springs.

Wheels, cast-iron centres, with steel tires 36 inches diameter. Wheels.

Axles of hammered iron or steel; journals, 4 inches diameter by 8 inches long, $5\frac{1}{2}$ inches wheel fit. Axles and journals.

Oil-tight boxes with brass bearings, accurately finished and fitted. Journal-boxes.

Brakes on both trucks, operated by suitable brake-shaft at forward end of tender. Brakes.

Tank-valves with strainers conveniently arranged, in front end of tank at bottom to connect with feed-pipes, and worked from foot-board by levers at top of tank. Tank-valves.

Tender connected with engine by indiarubber hose, one on each side, of best quality and proper size. Hose-connections.

Two safety-chains to connect tender with engine; also two for each truck, connecting front corners of trucks with tank-frame. Safety-chains.

Two tool-boxes, of iron, strongly made, with good locks, and strong strap hinges; to be placed on top of tender. Tool-boxes.

Particular care to be taken that all bearings of importance have good oil-cups, or cellars, capable of holding a proper worsted syphon or other efficient means of feeding oil. All oil-cups should have proper covers, well secured and dust-proof, as line is very dusty and hotbearings very common. Lubrication.

Especial care to be taken with boiler, rod, and frame work. Consider interchangeability with previous engines. Workmanship.

Tire section, as tracing 2,090.

BALDWIN LOCOMOTIVE WORKS.

Physical Tests of Materials.

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When annealed they must withstand flanging cold a flange $\frac{5}{8}$ of an inch broad for 2-inch tubes without cracking. Copper tubes must withstand flanging hot as well as cold. Tubes other sizes than 2 inches diameter must flange to a width proportional to their diameter.

A piece 30 inches long, annealed and filled with resin, must withstand being doubled until the extremities touch each other without showing defects.

A piece 30 inches long, not annealed, filled with resin, and placed on supports 20 inches apart, must withstand bending to a deflection of 3 inches without showing defects.

Bar iron

Bar iron should have a tensile strength of 50,000 pounds per square inch, and an elongation of 20 per cent., in section originally 2 inches long. Iron will not be accepted if tensile strength falls below 48,000 pounds, nor if elongation is less than 15 per cent., nor if it shows a granular fracture.

Chilled wheels

Of approved make, and of following guaranteed mileage:—

For 28" wheels ...	... 40,000 miles.	For 33" wheels...	... 50,000 miles.
" 30" " ...	... 45,000 "	Other sizes in proportion.	

(Adopted by Joint Committee of Master Car Builders' Association, American Railway Master Mechanics' Association, and Association of Manufacturers of Chilled Car-Wheels, November 21, 1889.)

Deficient mileage will be adjusted upon return of the defective wheel, or that part of same containing the defect causing withdrawal from service. Or, if preferred, wheels will be furnished subject to approved specification and drop test, without mileage guarantee.

Letter from Mr. Hoyle to Acting Minister for Railways (Sir Henry Parkes, G.C.M.G.)

Dear Sir,

Parliament House, 29 July, 1891.

I do myself the honor to apply for an order at your hands as Acting Minister for Railways, empowering me to inspect certain railway plant at Eveleigh Works, which plant, I am led to believe, is defective in construction and unfit for the service for which it has been imported, and generally of a nature to justify the most earnest scrutiny at the hands of the Government.

I do not desire to go to the Railway Works and incur the risk of being treated as an intruder.

When I have satisfied myself as to the statements that have been made I will do myself the honor to communicate with you.

To the Honorable Sir Henry Parkes, G.C.M.G.

I have, &c.,

H. C. HOYLE.

Letter from Secretary for Railways to Mr. Hoyle.

Sir,

Government Railways of New South Wales,

Secretary's Office, Sydney, 3 August, 1891.

I have the honor to acknowledge your letter of the 29th ultimo, addressed to the Honorable the Premier, asking permission to inspect certain railway plant at Eveleigh, which you are led to believe is defective.

I am directed to say that the Commissioners will feel obliged if you can furnish them with any information as to the defective plant referred to; they are more interested than anyone in securing only sound materials for the railway requirements, and on receipt of further and definite information will have a stringent inquiry made to elicit the facts of the case.

I have, &c.,

H. McLACHLAN,

Secretary.

H. C. Hoyle, Esq., M.L.A., Legislative Assembly.

Correspondence between Railway Commissioners and Minister for Railways *re* Mr. Hoyle's statements in Parliament:

Office of the Railway Commissioners of New South Wales, Sydney, 7 October, 1891.

In accordance with the wish of the Minister for Railways, as expressed in his minute of the 2nd instant, we beg to enclose a paper containing extracts from the speech of Mr. Hoyle, M.P., delivered in the Legislative Assembly, on the 20th August last, wherein he makes certain allegations relative to the American engines recently imported. Opposite each is placed the statements of our officers who have been referred to in the matters, together with other information, which bears on the question.

In submitting this paper we think it proper to state that, in our opinion, one of the objects in view by Parliament when we were appointed was the working the railways according to the most modern ideas, so that the greatest possible results could be obtained by the country, and that it was never expected that we should be tied down to working the railways on the lines that were in operation before we took office; as, if so restricted, our appointment would be of no benefit to the country.

It must be remembered that the railways have been constructed with a very large proportion of steep gradients, and the only way (now that the traffic is increasing so rapidly) to stave off an enormous amount of duplication work is to introduce more powerful engines, and so, by taking much larger trains at a better uniform speed, enable the single lines to carry for years to come the traffic which could not be carried with the present class of motive power, or system of short trains, without grave delays and inconvenience. In addition to this, greater safety is obtained by working trains with one engine instead of two.

With regard to the alteration of the platforms and slewing roads. Even admitting that these alterations were necessary to enable the new engines to be introduced, it was wise to incur the expenditure and so enable engines of 65 per cent. more power to be used. The increasing of the weight of engines and improvement of the permanent way of railways has been general all over the world for years past, upon the grounds of true economy, so as to increase the utility of the railways; and if the interests of this country are to be considered, we must follow the same course. Special allusion has been made to the necessity for all our lines being laid with 80-lb. rails in consequence of the introduction of the American engines. It is perhaps well to add to what is stated in the enclosed paper, that no such necessity exists so far as these particular engines are concerned, although it has been proved by experience that where traffic is heavy and incessant, and there is a growing necessity for increasing the speed and weight of trains, it is true economy to use this weight of rail; indeed, the principal English companies are now adopting a rail weighing 90 lb. to the yard. The late Engineer-in-Chief (Mr. Whitton) considered the question of increasing the weight of our Permanent Way with us early in the year 1889, and cordially concurred in the step we proposed to take, and Sir John Fowler also cabled (May, 1889), through the Agent-General, advising us to adopt a heavier section of rail and heavier chair.

With reference to the allegations, as a whole, made by Mr. Hoyle, M.P., in his speech delivered on the 20th August last, it is perhaps well to mention that, in connection with a letter he had addressed to the Premier, a letter was sent to him by our direction on the 3rd August, being seventeen days prior to his speech, stating that we should feel obliged if he would furnish us with any information he might possess with regard to the defective railway plant referred to by him, pointing out that we were more interested than any one in securing only sound materials for the railway requirements, and promising, on the receipt of definite information, to have a stringent inquiry made to elicit the facts of the case. To this communication no reply has been received.

We hope that sufficient information is given to enable the Minister to deal with the matter as he wishes, and we would point out, although it should be quite apparent to every one, that our reputation in working the railways well and economically is of too great value to us to admit of the slightest risk of our doing anything that is not in the interests of true economy, and for the benefit of the country.

W. M. FEHON.

CHARLES OLIVER.

It was my intention to lay these statements concerning the charges made by Mr. Hoyle upon the Table of the House as a return. I trust my successor will do so in justice to the railway management, adding thereto the correspondence which passed between the Treasury and Messrs. Hoyle and O'Sullivan in the endeavour to induce those gentlemen to give to the Railway Commissioners through me any future information they possessed bearing on the matter. I think in the interest of the travelling public, and of the reputation of our railway management, these facts should be made widely known.—B.S., 23/10/91.

Mr. Hoyle's statement :—

"That a large blunder has been made by some officer in the Railway Department."

"The engines that have caused all the trouble were quite unnecessary, and should never have been ordered."

Remarks :—

Nothing of the kind occurred. The necessity for additional engine power was so pressing (as will be seen by subsequent remarks) that prompt delivery was most essential, and as the Baldwin Company offered terms in regard to expedition which were most satisfactory, an order was placed with that firm. The class of engine ordered was similar in type to locomotives which had performed exceptionally good work on the long inclines of the Baltimore-Ohio Railway. After manufacture, and before shipment, one of the engines was tested with the load which the Commissioners specified, and performed its work successfully, fully meeting all the requirements laid down.

So far back as May, 1886 (over five years ago) the then Locomotive Engineer, Mr. Scott, strongly urged that additional locomotives be obtained, stating : "On the northern line there are not sufficient goods engines now in stock to meet the traffic, and when the line is open to Tenterfield we shall have very great difficulty in meeting the increased requirements, so that it is absolutely necessary that more locomotives be supplied at the earliest possible moment." Again, "When the new extensions are opened (Southern and Western lines) an increase to our passenger stock will be indispensable." At the end of 1885 the locomotive stock numbered 392, and the mileage open 1,732 miles. Since that date the mileage has increased (on the date of the last Annual Report, June, 1891), to 2,182 miles, while the locomotive stock had only grown from 392 to 439. Had the engines been increased in proportion to the mileage, the number should have been 500 engines. Again, the traffic receipts in 1885 were £2,174,368; in the last financial year they increased to £2,974,421, while, as estimated, the locomotives only increased from 392 to 439. Had the engines been increased in relative proportion to the earnings, the number at the close of June should have been 536, or 100 more than the effective strength. It is not considered that these are the absolute factors to be regarded in determining the number of locomotives required, but they unmistakably illustrate the absolute necessity that existed, if the lines were to be satisfactorily worked, for the locomotive power being greatly augmented.

It may be further mentioned that under date 19th May, 1888, the then Locomotive Engineer reported to the late Commissioner for Railways that, "It is of vital importance that my previous recommendations for increasing the number of passenger and goods engines should receive due and timely consideration."

In the report made by the late Commissioner for Railways, under date the 20th July, 1888—to which the Locomotive Engineer's report referred to was appended—the following paragraph will be found :—

"In my report for 1886 I drew attention to the necessity for the supply of additional locomotives for adequately meeting the requirements of the traffic, and supported the statement by a reference to the statistics of locomotive work performed in Great Britain, in the various countries forming the continent of Europe, and in America, which showed that, with one exception, the locomotives in use on the lines in New South Wales were more heavily worked than the locomotives of any other country. The twenty additional engines supplied during 1887 afforded some relief, but more are required, and it is questionable whether the fifty engines recently ordered from Colonial manufacturers will be supplied in time to meet the demands."

Subsequently he wrote under date 20th October, 1888 (two days before the appointment of the present Commissioners), as follows :—

"The rolling-stock has been fairly well maintained, but the necessity for additional stock in certain classes becomes every day more apparent. The supplies now

Mr. Hoyle's statement :—

He wrote to the traffic manager, asking him what was the load he desired to carry, and the traffic manager replied as follows :—

I return the papers herewith, and from inquiries I have made I find that an engine capable of maintaining a speed of 35 miles per hour on an ordinary road, and of drawing thirteen loaded vehicles up an incline of 1 in 30 or 33 would meet the requirements of the department. I do not mean, of course, that a speed of that kind should be maintained upon such an incline, because that would be impossible. It will be a great desideratum if such an engine can be procured for our passenger trains, because I quite concur with Mr. Midelton, that it is undesirable to have two engines doing the work of one, as they have very frequently to do at present.—W.V.R., 25/4/83. Mr. Midelton.

We are here told that the load to be drawn with safety, with the draw-gear attached to the rolling stock at the present time, was considered to be thirteen loaded railway carriages, or twenty-five loaded goods trucks. Now, I would ask if a train of thirteen vehicles of one class, and twenty-five vehicles of another class, was all that the department considered the draw-gear able to carry, what was the use of ordering an engine from America capable of drawing 100 trucks?

We have ordered from America engines to do work which we have engines here already capable of doing.

During the late strike the traffic in the Railway Department was heavier than ever it was before. Goods could not be carried by sea-board, and the railways were used to their utmost capacity; yet, under those circumstances, we had sufficient engines, and the work was done without any hitch in the traffic. We had plenty of locomotives, and were only deficient in trucks. Although we had plenty of machinery to do that work, immediately

Remarks :—

under order will meet the requirement to a large extent. I have for the last three years pointed out that more locomotives were required. So much time has been lost in obtaining satisfactory contracts that the locomotive now under manufacture by colonial makers will not be supplied in time to meet pressing wants. Tenders have consequently been invited in England and America for the supply of ten locomotives for immediate use."

Of the sixty engines referred to in the paragraphs quoted, fifty were never supplied, as the colonial manufacturers failed to deliver a single engine.

Nothing further need be said as to the allegation that the engines were "quite unnecessary."

Mr. Thow, the Chief Mechanical Engineer, states :— "The reference is no doubt intended to apply to the engine manufactured by the Baldwin Co., and set to work in July, 1885. I have ascertained that the Minister for the day ordered these engines to be tested in 1887, both on goods and passenger trains with loads for passenger trains of thirteen vehicles, and for goods trains of twenty-five vehicles. This was done, and the tests showed clearly that the engines were quite unequal to the work, and the experiment was abandoned on account of delays on the road, and the unsatisfactory working of the traffic. Therefore it is manifestly an improper representation on the part of Mr. Hoyle, no doubt made without personal knowledge, that these engines had taken the loads which he mentions. As a matter of fact, at the present moment—and I may say that the engines are loaded to their utmost capacity—they are scheduled to take twelve small passenger carriages—equal to four of the lavatory type, and eighteen goods waggons loaded, but even then they must be assisted on any grade steeper than 1 in 40, when attached to goods trains. Mr. Hoyle is manifestly speaking from wrong information given to him." Then on the subject of draw-gear. It is a totally different question now since the light draw-gear has practically been entirely removed, thus enabling us to take much heavier trains; but the whole question is not one of draw-gear so much as the greater safety obtained by working-trains with one engine instead of two. It may also be added that the comparative values of the engines should be judged by their relative power to haul given loads up 1 in 40 grades. Unfortunately, to a large extent our loads are determined by this standard, and not by haulage power on the level.

The engines referred to are "passenger engines" and not "goods engines." At the date of these statements no "goods engines" had arrived. On this point, Mr. Thow states :—"Mr. Hoyle is wrong in stating that we have engines here capable of doing the work of those ordered from America. That is not correct. The power of these engines (passenger) must be compared, not with goods engines at present on our system, because they are intended for passenger work; the comparison must be made with passenger engines, and if that is done, for the same speed,—the new passenger engines are 65 per cent. more powerful than the strongest passenger engines at present on our lines. In other words, the most powerful passenger engines we had prior to the arrival of the new American engines are scheduled to take a load of 120 tons up a grade of 1 in 40 at 12 miles per hour. The engines in question will take 200 tons over the same road at the same speed.

Mr. Kirkcaldie, the Chief Traffic Manager, states :— "Our greatest difficulty during the last wool season was due, not so much to the want of waggons as to the insufficient supply of engine-power to move them, and the traffic was on many occasions seriously impeded from this cause. Since then, and even at the present time, notwithstanding the increased power that has recently been obtained, the Locomotive Department is unable at times to supply all

Mr. Hoyle's statement :—

afterwards we find the Government allowing the Commissioners to send to England for over 100 locomotives. Why was it necessary to incur such a large expenditure when we had quite enough locomotives in the country ?

When he (Mr. Neale) got Mr. Thow's back turned, he ordered twelve locomotives to be made on the pattern of those used on the Baltimore-Ohio Railway.

Mr. Neale knew that we only had a 70-lb. rail on our main lines, with the exception of a few rails lately laid down on the suburban lines. But the Baltimore and Ohio railway authorities were running their engines on an 80-lb. rail, and an order was sent that the new engines were to be made a little lighter. And what was the result ? According to the daily papers, these engines were brought here to haul a load infinitely greater than could be drawn by any engine at present in the Colony. We find that by making the engines a little lighter there is too much power in the cylinder. There is an excess of weight on the driving wheels, and whenever the full power of the cylinder is used, instead of the engine pulling the load, the wheels skid round and do not draw the load at all.

That whereas, when Mr. Midelton was in the service, he reduced the types to three, we now find that there are forty-seven types. This means a large additional expense, as distinct stocks of patterns are required for each part of the engine.

I am informed, on what I believe to be very high authority, that these engines are decidedly of a very defective character. I am told that the wheels of one of the engines had to be taken into the shop and put into the turning lathe. The engine had not been out more than four times when she was brought back into the shop and had to be lifted and the wheels put into the lathe and turned. I am also told that four spokes either in the driving wheels or the trailing wheels were broken.

It is a serious defect of the engines that they are too wide for the platform.

Remarks :—

the engines required. This is especially noticeable on the days immediately preceding the live stock sales at Homebush, when the demand for engine-power is so great for the haulage of stock, that wool and other produce is frequently delayed. In view of the undue strain to which our locomotives have for a long time been subjected, I am decidedly of opinion that the increased traffic could not possibly be coped with, either with credit to ourselves or to the satisfaction of the public, unless the engine-power is very considerably added to."

Mr. Thow further states :—"Mr. Hoyle is also assuming that we had sufficient engine-power to do the business of the country last year. It is true that by unusual efforts and by suspension of proper repairs, the work has been done ; but it resulted in a strain on the locomotive stock to an extent, which it would not possibly endure if repeated. The fact that nearly two-thirds of our engine stock available for work, averaged over 25,000 miles, and that many of them exceeded 40,000 miles during the year, is a proof, from an engineering point of view, that the engines were being unduly distressed, necessitating an abnormal and improper expenditure for repairs. The average mileage in England is about 18,000 miles per engine per annum."

This is quite incorrect. Mr. Neale had nothing to do with the matter. The engines were ordered by the Railway Commissioners under the circumstances previously stated.

By cable received from Messrs. R. W. Cameron & Co., agent for the New South Wales Government in America, the inaccuracy of the statement as to the weight of rail used by the Baltimore-Ohio Co. is confirmed. Their standard rail is 67 lb. (steel). As to the power of the cylinders Mr. Thow states :—"Mr. Hoyle is misinformed as to the power of the cylinders being so great as to skid the wheels of the new American engines. This is not the case. The engines are well proportioned in that respect, and they do not skid, or rather slip, that being what Mr. Hoyle means, unless they are working over a greasy rail in damp weather or in tunnels, and any engine would, under similar circumstances, do so."

Mr. Thow states :—"Mr. Hoyle is also quite misinformed on the subject of types of locomotives. When the Commissioners took office, there were forty-two types, and they are still in use, but as new engines are obtained, the types are being reduced."

Mr. Thow states :—"Mr. Hoyle is also misinformed as to the alleged defects in the new passenger engines. It is true that one of the engines has had the wheels removed and placed in the lathe, but that was due simply to a flat place having been worn in the wheels in consequence of the driver reversing the engine and putting on steam suddenly and under most exceptional circumstances, in no way due to the engine so as to stop his train as quickly as possible. The same thing would have occurred with any engine that a driver had handled in so smart a manner. As to the statement that four spokes were broken in these wheels it is incorrect."

Mr. Thow states :—"I find that the specification sent to America definitely stated that the width over cylinders of the new Baldwin engines in question was to be 9 ft. 3 in. This width is less by $\frac{1}{4}$ of an inch than the width of the cylinders of the consolidated engines which have been running in the Colony since 1879.

"The actual width over the castings of the new engines varies from 9 feet $3\frac{1}{4}$ inches to 9 feet $4\frac{5}{8}$ inches. The maximum average width is 9 feet $3\frac{3}{4}$ inches, or $\frac{1}{8}$ inch wider than the limit ordered by the specifications. The makers' drawings show that the width intended by them is 9 feet 3 inches, as specified. The width over the Mann car, which was ordered prior to the Commissioners taking office, at the same

Mr. Hoyle's statement :

Remarks :—

I am informed that one of them is now at Newcastle, and that another has been lifted four times.

Another point is that, according to the latest information from the cleverest men in the United States, from boards of railway management there, these engines cannot run with safety on a rail less heavy than 80 lb., and therefore if we run them on our main trunk lines, we shall have to lay down a new permanent way from Granville to Albury, from Granville to Bourke, and from Strathfield to Wallangarra.

I challenge the Railway Department to put these engines into competition with those lately designed by Mr. Thomas Midelton, and to give them a trial similar to that made in 1887. I am willing to stake my existence on the fact that we have engines in the service that can do anything to be done by these engines from America, and it would be cheaper to throw them on the stack heap than to relay the permanent way as I have described.

The attached excerpts* from *Hansard* contain Mr. Hoyle's speech, in which he charges the Railway Department with certain maladministration and blundering, in connection with the ordering of certain locomotives from America and England. In order that these charges may be fully and completely dealt with, I desire the Railway Commissioners to call upon the respective officers, most competent for the purpose, to report upon these several charges, as numbered, in the order of their rotation. I should like the reports to be full and conclusive, as it is my intention to write a minute upon them when they are before me, and, ultimately, to lay the charges and the reports, together with my minute, upon the Table of the House in the form of an answer to Mr. Hoyle's speech. I should like this matter to be dealt with as promptly as possible, as it has already stood over some time since the speech in question was delivered.

BRUCE SMITH,

2/10/91.

H.

height from the rail as the engine cylinders, is 9 feet, but its width over the body, which is above the level of the cylinders, is 9 feet 4 inches. Although the engines are slightly wider than laid down in the specifications, the difficulty with the platforms has been for the most part created by the standard adopted by the late Engineer-in-Chief, Mr. Whitton, not having been maintained or observed. This departure has given great trouble with old stock, and the direction to place the platforms to gauge had been given long before the American engines were ordered."

Mr. Thow states :—"No extensive alterations have been made. The locomotives have not yet failed through any defect in workmanship. Some slight alterations have been made to give greater security to the men, such as short hand-rails on the tenders, and a locking-catch on the reversing screws. The cost of the hand-rails, about 15s. for each engine, will be borne by the Department, and the cost of the locking catches will be charged to the manufacturers. There has not been any work done upon these engines of an unusual character. All new engines give a little trouble at first, no matter where they come from, and some that were imported in 1885 and 1887 gave far more trouble and cost a larger amount."

This is altogether fallacious. Messrs. R. W. Cameron & Co., agents for the New South Wales Government in America, cabled, on 28th August last, that this class of engine is in general use in America with favourable results, weight better distributed and less destructive of rail, and that the Baltimore-Ohio Co. use 67 lb. steel rails, and not, as stated, 80 lb. It may be here specially noted that engines with a greater weight per axle have been running upon our lines for years. As "the cleverest men in the United States" are not mentioned by name, it is difficult to determine who are referred to. It is, however, worthy of mention that the Committee appointed by the Master Mechanics' Association (the Locomotive Superintendents of the United States) state (June, 1891) that the limit of weight in their opinion is 14 tons 6 cwt. per axle for rails under 60 lb., and 16 tons for rails above that weight. They further recommend for fast passenger and goods traffic a ten-wheeled engine, similar to those obtained from the Baldwin Co., and having 14 tons 15 cwt. on the driving-wheels, being almost exactly the weight of the engines under discussion. They also state that engines with ten wheels are safer on crooked roads than Mogul engines of the type referred to by Mr. Hoyle.

Mr. Thow states :—"As to Mr. Hoyle's challenge to the Railway Department to put these engines in competition, and to give them a trial similar to that made in 1887, I have already shown that the engines referred to failed utterly in that trial with the loads which the Minister ordered they should be tested with, and it would simply be a ridiculous experiment to hold any competition whatever between engines which have an absolute power of something like 65 per cent. more than the engines referred to by Mr. Hoyle can exert." As to repetition about relaying permanent way, see previous reply.

*See marginal extracts from Mr. Hoyle's speech.

H.

Sir,

Parliament House, 2 September, 1891.

I do myself the honor to acknowledge receipt of your letter of the 1st inst., again inviting me to favour Mr. Bruce Smith with a call, in company with Mr. O'Sullivan, M.P., to supply any information of value on the subject of the lately imported American engines, and offering the assurance of the Treasurer that the information to be supplied by me shall be held as confidential.

In reply, I have the honor to intimate that in my letter of the 27th ultimo I have already declined to act as public prosecutor in any such form of inquiry.

That I have stated as my opinion that Mr. Smith does not possess the necessary knowledge to hold an inquiry of the kind which the public demands.

That no inquiry short of the most searching investigation on the part of a Select Committee of the House, on oath, will be effective.

That I have offered to provide such Committee with all the information and names at my disposal; and further, I would point out that the offer of any information to be considered confidential has no weight with me.

I desire no assurance and no screening in the discharge of my public duty, and I again urge the Minister for Railways to consent to an inquiry of the kind I have suggested, and which the Premier promised.

In conclusion, I assert that the use of these American engines lately imported to drag heavy loads, and to run on our steep gradients, on our lines, is a public danger; and I warn the Minister that any paltering on his part with the gravity of this question endangers the safety of the travelling public, and the responsibility of any accident which may happen must rest on the backs of those who delay the only investigation that will satisfy the Parliament and the people.

I await your reply before bringing this correspondence before the House.

I have, &c.,

F. Kirkpatrick, Esq., Under-Secretary, Treasury.

H. C. HOYLE.

Seen.—B.S., 3/9/91. Correct this misinterpretation. Inform Mr. Hoyle that it was only the source of the information I promised to regard as confidential, in deference to his disinclination to appear as a public prosecutor. This should be regarded as one of the charges to be dealt with.—B.S. Mr. Galloway.—F.K., 3/9/91. Mr. Hoyle informed.—F.G., 3/9/91. Records.

My dear Sir,

Parliament House, Sydney, 27 August, 1891.

The accompanying letter to the Minister is of the greatest importance, and I will be much obliged if you will kindly put it before the Minister at once.

Yours, &c.,

H. C. HOYLE.

Submitted.—F.K., 28/8/91. Fix 12 noon, Sept. 3, for hearing any information which those gentlemen, Messrs. Hoyle, Midelton, or O'Sullivan, have to give.—B.S., 28/8/91.

My dear Sir,

Parliament House, Sydney, 27 August, 1891.

I have the honor to acknowledge your letter of the 25th instant, in which you inform me the Honorable the Colonial Treasurer has determined to inquire personally into the whole matter of the lately-imported engines for the Railway Department, and asking if it would be convenient for me to meet Mr. Smith with a view to the grounds of my complaint being fully stated as a basis for such inquiry.

In reply, I beg to state that my complaint with regard to the inquiry in question is not of a personal character, but made for the purpose of bringing before Parliament certain evidence which has been communicated to me in the interests of the public, and from statements made, as I believe, of a reliable character, and of so serious a nature as to demand instant inquiry.

The Premier fully comprehended, and stated in his reply to me on Thursday last, *vide Hansard*, No. 12, page 1103, what the duties of the Government are in this matter, and the rights of Parliament.

I do not think an inquiry by Mr. Bruce Smith will sufficiently develop the gravity of the charges to be inferred from my statements, and any individual inquiry, even by a Minister of Mr. Bruce Smith's ability, will fail in obtaining the necessary information upon which a sound conclusion can be arrived at; and further, I decline to place myself in the position of a public prosecutor.

But I venture respectfully to point out that the whole truth in regard to these engines can only be obtained and brought to light in such a manner as will give confidence to the Parliament, the Government, and the public, by the most searching inquiry before a Select Committee of the ablest men of the House, at which the Government can be fully represented, and by obtaining all the evidence upon oath of the several witnesses; and that the inquiry should be searching and complete, I will gladly furnish such Committee with the names of the parties who can give evidence, and such Committee further can see with their own eyes many of the faults which such a form of inquiry will elicit.

I have, &c.,

F. Kirkpatrick, Esq., Under-Secretary for Finance and Trade.

H. C. HOYLE.

Office of the Railway Commissioners of New South Wales,

Sydney, 7 November, 1891.

The Honorable the Minister for Railways.

With reference to our minute of the 7th ultimo, we beg to report for your information that three of the Baldwin passenger engines have shown weakness in the axles of the bogie carriages. The weakness in these parts points to the desirability of removing the engines from express passenger traffic until the cause can be fully ascertained, and this has been done. At the present time it would be unwise to cast the responsibility upon the manufacturers, but it is proper to state that the description given of the engines when ordered in no way warranted locomotives being supplied which were not fully equal in every respect to express service.

In

In order that no misunderstanding may arise as to the particular axles referred to, it is desirable to say that they are those under the bogie carriages in the front of the engine, and not the axles of the driving-wheels, which have shown no defects.

As regards the engines, they have done excellent work, and are favourably spoken of by the drivers who have worked them. We propose to put in stronger axles, and in this way expect the defect to be cured.

Although the engines have been taken out of the "Express service," they will be most advantageously used in other work, and prove, owing to their large hauling power, a most useful addition to our locomotive stock in the present time of pressure.

W. M. FEHON, Commissioner.

CHARLES OLIVER, Commissioner.

Office of the Railway Commissioners of New South Wales,

Sydney, 18 November, 1891.

As desired by the Minister for Railways, we beg to furnish him (in addition to the information we have previously been able to afford) with particulars of the circumstances under which the Baldwin engines were ordered, and experience of them since delivery.

It will be remembered that when we took office the engine-power of the New South Wales Railways was quite unequal to the then existing traffic, and consequently there was no hope of coping with any expansion of it. At that time there were under order in Sydney (the order having been given in December, 1887) twenty-five passenger engines from the Atlas Company, and twenty-five goods engines from T. Wearne & Co., but neither of these companies delivered an engine. In January, 1889, ten passenger engines were ordered from Messrs. Dubs & Co., of which five were delivered in January, 1890, and the balance in April of that year. In August, 1889, an order was given to Messrs. Dubs & Co., for twenty-five goods engines, which were delivered in February, March, April, June, and July, 1891. In the same month (August, 1889) six tank engines were ordered from Messrs. Beyer, Peacock, & Co., which were delivered in January, February, and March, 1891. In June, 1890, a further order was given to Messrs. Beyer, Peacock, & Co., for another six tank engines, which were delivered in June and August, 1891. To this date (and here it must be borne in mind that the traffic had increased from the date of the ordering of the fifty engines from the Atlas Company and Messrs. T. Wearne & Co. from £2,212,718 to £2,633,086, an increase of £420,368) we had only ordered forty-seven engines out of fifty it was deemed necessary to order nearly three years previously, and that out of the forty-seven engines thus ordered thirty-seven were not delivered until four years after the order for the fifty engines—indeed, the delivery of the majority exceeded that period.

The pressing necessity for engine-power continued, and could not be resisted, and in August, 1890, an order was placed with Messrs. Beyer, Peacock, & Co. for fifteen double bogie tank suburban engines, of which only six have been delivered. The struggle to meet traffic requirements was immense, and the cost of repairing and patching up worn out engines ruinous, and we had for a considerable time recognised the necessity of something being done to make better provision for the supply of engines, both as regards more expeditious delivery and better supervision. So far back as May, 1889, we addressed a letter to the Minister for Railways, urging that steps be taken to establish locomotive works, and for a time it appeared that this would be attended with success. However, the negotiations ultimately fell through, chiefly, we believe, in consequence of the price tendered by the firm who contemplated opening works being too low to leave a fair margin of profit.

Before we were aware that the parties whose tender had been accepted (and it may here be mentioned that the inducement to establish the works was an order for 100 engines at a specified price and subject to certain conditions, full particulars of which are given in papers printed by order of the Legislative Assembly, under date the 1st May, 1890) would retire from the contract, and, in order to save time in commencing the manufacture of the locomotives, we sent Mr. Thow, the Mechanical Engineer, to England, to confer with the Engineer of the Company, and settle details of the engines, so that he could commence to build with the least possible delay after arrival in the Colony. On Mr. Thow's arrival in England, he found that there was a disinclination to go on with the contract. This upset all our calculations as to obtaining engines, and we had to adopt some other course. It was decided, if the contract fell through, to place some orders with Messrs. Dubs & Co. and Messrs. Beyer, Peacock, & Co.; but much difficulty was experienced in getting these firms to accept orders for the delivery of engines within a reasonable time, they being so full of home and foreign orders. While matters were in this unsettled state, and after much consideration, we determined (12th September, 1890) to order twelve passenger engines from the Baldwin Company, and selected a type of engine which had done excellent work on the Baltimore and Ohio Railway, and here we wish it to be most clearly understood that we adopted this course to meet to meet the pressing necessities of the traffic, relying on the world-wide reputation of the Baldwin Company to supply good engines of the class mentioned (with specified modifications to meet our requirements), and in addition to this ensuring prompt delivery.

On the 10th October, 1890, we were apprised of the breaking of the contract for the establishment of locomotive works in the Colony, and took steps to make the best terms we could with Messrs. Dubs & Co. and Messrs. Beyer, Peacock, & Co. Eventually an order was given to the former for twenty mineral tank engines, and the latter for fifty passenger engines. Although prompt delivery was pressed for, it soon became clear to us that it could not be relied upon, indeed, although some of the engines have been shipped, none have yet arrived.

Again we felt it necessary to take some special steps to obtain engines promptly, as without increased locomotive power we could not hope to cope with the anticipated increased wool traffic, and on the 29th December last we ordered twenty goods engines of a specified class from the Baldwin Company.

The twelve passenger engines ordered from the Baldwin Company in September, 1890, were delivered in July last, and the twenty goods engines in September.

As already reported, the passenger engines, while proving highly satisfactory as regards hauling power, have shown defects in construction. These defects are reported to be mainly as follows :—

- (1) Heating of axle-boxes of the engine and tender bogies.
- (2) Breaking of engine bogie and tender axles.
- (3) Breaking of reversing lever fulcrum pin.

The heating of the axles is due to defective construction of the brasses added to by unsuitable material having been used for packing. The Baldwin Company were specially instructed in regard to this matter as follows :—“Particular care to be taken that all bearings of importance have good oil-cups or cellars capable of holding a proper worsted syphon or other efficient means of feeding oil. All oil-cups should have proper covers well secured and dust-proof, as our line is very dusty, and hot bearings are very common.”

The breaking of the three engine bogie axles is due to defective material, the faulty axle-box only being a contributory cause to the failures.

The failure of the reversing gear is consequent upon the bolt which secures the reversing lever to the bracket in the boiler breaking. The bolts have been strengthened. This, however, is but a trifling defect.

The driving axle-boxes of the coupled wheels are also reported to have undue lateral wear. This will be remedied by a slight addition to the axle-boxes.

It is further reported that the engine brake-rods have in some instances broken at the joints, owing to bad workmanship.

In two instances the fire-box roof, stays, and tubes have leaked; but the appearance of the lead plugs points to this having arisen from shortness of water, which is of course the result of carelessness, and not a defect in the engines.

Some additions to the reversing screws have been necessary, and the tender draw-hooks are lighter than our present standard.

All the defects mentioned are capable of being remedied, and the Baldwin Company will be called upon to bear the expense.

As regards the defective bogie axles, which is really the only important matter, they have already despatched fresh axles from America to take their place.

With regard to the specified alterations which necessitated departure from the type of Baldwin engine selected as a pattern, it is thought desirable to attach a copy of a letter from Mr. Rhodes, their engineer here, on the subject. Mr. Thow, our Chief Mechanical Engineer, has also expressed his views, and a copy of his memo. is appended.

We hope to be able to acquaint you upon an early date of the final result of the investigations now being made, and also as to the settlement arrived at with the Baldwin Company.

No one regrets more than we do the failure of the engines, yet we feel sure that the reputation of the Baldwin Company, in which we placed so much reliance at a time of unprecedented pressure, and, indeed, inextricable difficulty for want of engine power, for which we were in no way responsible, will be of too great value to them to allow the Colony to suffer any loss from defects in the locomotives supplied.

While the engines have not met our expectations they are doing good work, the material failures occurring when the passenger engines have been called upon to run long distances at a high rate of speed. As stated in our minute of 7th November, these engines have, for a time, been taken out of fast passenger work, and otherwise profitably employed.

W. M. FEHON, } Railway
CHARLES OLIVER, } Commissioners.

There is ample money in hand on account of the purchase of the Baldwin engines to defray the cost of making good any defects found in them.

W.M.F.
C.O.

[COPY OF ENCLOSURE.]

Sydney, 17 November, 1891.

The Secretary, New South Wales Government Railways,—

Dear Sir,

Referring to your personal request that I would inform you how the engines *ex* Henley differ from those of a similar class in America, I have the honor to report as follows :—

The difference between them is that the former have copper fire-boxes and brass tubes, screw reversing gear, screw engine and tender brakes, and a few other minor details.

The pattern Baldwin engine has only been departed from to keep the engines within a limit of weight, height, and width, and I do not consider any of these departures an element of weakness.

I have, &c.,
WM. RHODES.

The Secretary,

Eveleigh, 18 November, 1891.

Referring to your minute of even date, as I have before expressed, I am unable to say that there is any difference between the American engines which are running there and those sent to this country, with the exception that our engines have copper fire-boxes and brass tubes, instead of steel, generally used in America; but that alteration would undoubtedly be in favour of the engine. I am not aware of any alterations made here that could possibly “affect the stability” of the engines, nor, indeed, of any alterations of a material character whatever, beyond adding a few details to make the engines work better; certainly nothing has been done here to my knowledge which would be an “element of weakness” in them.

W. THOW,
Chief Mechanical Engineer.
Office

Office of the Railway Commissioners of New South Wales, Sydney, 24 November, 1891.
 SINCE writing our minute of the 18th instant we are in receipt of the attached cable from Messrs. R. W. Cameron & Co., agents for the New South Wales Government in the United States. Some doubts having been raised as to whether the Baldwin passenger engines recently supplied were capable of running at so high a rate of speed as is required in our express service, inquiry was made of Messrs. R. W. Cameron & Co., which resulted in the receipt of the wire just previously referred to.

It will be seen that in America these engines run up to a time-table speed of 50 miles per hour, so they should be quite equal to our express service.

From the cable it would also appear that the engines of this class are highly thought of by leading railway companies.

As regards the opinion expressed in the cable as to cause of failure, it has been already reported as a contributory cause; but the primary cause is the defective material in the axles.

W. M. FEHON, } Railway
 CHARLES OLIVER, } Commissioners.

Copy of Telegram from New York, dated 21 November, 1891.

HAVE returns, nine railroads using similar engines, distance 100 to 300 miles; weight of cars, 185 tons, 380 tons, Baltimore-Ohio, Michigan Central and Erie Roads; speed per time-table up to 50 miles per hour. Erie considers them best engines built; just placed order with Baldwin for forty-five; intend equipping their entire roads. Opinion expressed cause of failure bogie axles improperly lubricated or sand heating bearing journals.

Re Repairs, Baldwin Engines.

Office of the Railway Commissioners of N. S. W., Sydney, 5th May, 1892.
 I HAVE the honor to forward herewith information as asked for with reference to the cost of repairs of the Baldwin locomotives recently supplied.

I may say I have omitted the cost of repairs in connection with the replacement of the axles which were admittedly defective, and the cost of which was charged against the Baldwin Company, as shown in statement already put in.

12 Passenger Engines.

The cost of repairs and alterations have been as follows, and statements are attached giving details:—

	Total.	Average per engine.
A. Alterations	£113 9 10	£9 9 2
B. Shop repairs (excluding cost of repairs through accident, £79 9s. 10d.)	375 17 4	31 6 5
C. Running repairs	481 2 7	40 1 11

With regard to the first item I may point out that the cost was principally for small extras which the makers could not be called upon to supply, and which we, in conformity with our practice, thought it well to provide; such as fixing hand rails in front of tenders, fixing coal board to tenders, shield plates for fire-room doors, frames for departmental notices in cabs, part costs in connection with testing axles, and for slight alterations to brake-gear and shoes.

With regard to the cost of shop repairs, the heaviest items were in connection with repairs necessitated through errors on the part of employes.

The running repairs, considering the work the engines have done (being seven months at work and running 213,861 miles) are reasonable.

20 Goods Engines.

The cost of repairs to Goods engines have been as follows; details attached:—

	Cost.	Average.
A. Alterations	£340 18 3	£17 0 11
B. Shop repairs (excluding cost of repairs through accidents, amounting to £198 11s. 11d.)	51 17 2	2 11 10
C. Running repairs	662 12 11	33 2 8

As before explained, we have ordered a number of small extras aggregating in cost £340 18s. 3d., the work embracing fitting lamps and irons and coal boards, additional water gauges, tender bogie hook (repair) and adding stays and arm of tender brake shaft, fitting hand rails to tenders, 2 foot-boards each engine, shield-plate, fire-door ring, frames for departmental notices in cabs, fitting strainers to manholes of tanks, alterations to brake shoes and gear, additional water carrying capacity for special purpose.

With regard to the shop repairs, the largest items were for repairs through damage done by slight collisions, &c.

The shop repairs are reasonable when compared with the work the engines have done.

I also furnish below statement showing cost of repairs to 10 Dubs engines (436 class) when first run, and prepared in same way as those referring to repairs in connection with the Baldwin engines. The totals are as follows:—

	Cost.	Average.
A. Alterations	£827 12 6	£82 15 3
B. Shop repairs (excluding cost of repairs through accidents)	316 19 7	31 13 11
C. Running repairs	417 7 8	41 14 9

H. McLACHLAN,
 Secretary.
 ALTERATIONS,

ALTERATIONS, &c., debited to the Department—12 Passenger Engines.

No. of order.	Date of issue.	Particulars of work.	Date of completion.	Expenditure to the 11th February, 1892.	Expenditure from 11th February, 1892, to 27th March, 1892.	Total expenditure to 27th March, 1892.
				£ s. d.	£ s. d.	£ s. d.
3,427 } 3,481 } T. 48	30/10/91	One moiety of cost of testing axles	31/12/91	16 19 3	.....	16 19 3
	25/9/91	One half of cost of finishing work not completed. Nos. 446, 450, 2, 4, 6, 7	3/12/91	23 10 4	.....	23 10 4
3,230	30/7/91	Fixing hand rails in front of tenders	10/9/91	32 1 3	.....	32 1 3
3,265	14/8/91	Fixing coal boards to tenders		4 14 10	.....	4 14 10
3,350	24/9/91	Shield plates for fire door rings	28/1/92	3 16 0	.....	3 16 0
3,376	2/10/92	Making frames for notices in cabs		0 18 9	.....	0 18 9
3,424	29/10/91	Fitting strainers in manhole of tanks	28/1/92	12 5 0	.....	12 5 0
3,579	27/1/92	Alterations to brake shoes	25/2/92	3 9 5	.....	3 9 5
3,594	1/2/92	„ reversing gear		0 5 4	11 1 3	11 6 7
3,635	25/2/92	„ valve buckles .....		.....	4 8 5	4 8 5
				98 0 2	15 9 8	113 9 10

SHOP Repairs to 12 Passenger Engines.

No. of engine.	Where required.	Details of repairs.	Wages.	Stores.	Charges.	Total.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.
446	Eveleigh	Lining engine boxes	16 14 8	6 6 11	4 3 8	27 5 3
447	„	„ „	16 14 8	6 6 11	4 3 8	27 5 3
448	„	„ „	16 14 8	6 6 11	4 3 8	27 5 3
449	„	Accident repairs in consequence of accident at Clyde. (Crosshead slipper lined up, &c.)	50 3 11	3 19 3	11 0 9	65 3 11
		Lining engine boxes	16 14 8	6 6 11	4 3 8	27 5 3
450	„	Wheels turned through flats in tires	20 14 9	.....	4 11 4	25 6 1
		Lining engine boxes	16 14 8	6 6 11	4 3 8	27 5 3
		Straightening foot-plate damaged by derailment of engine at Wollongong	10 14 0	1 0 1	2 11 10	14 5 11
		Repairing axles-boxes of tender and fitting steel plates to lower tender	2 13 3	.....	.....	2 13 3
451	„	Lining engines boxes	16 14 8	6 6 11	4 3 8	27 5 3
452	„	„ „	16 14 8	6 6 11	4 3 8	27 5 3
453	„	„ „	16 14 8	6 6 11	4 3 8	27 5 3
454	Eveleigh	Fitting bogie axles to engine—new bogie axle boxes, new tender axle brasses and liners fitted, all engine axle boxes keeps taken down and repacked	8 8 0	.....	.....	8 8 0
455	Eveleigh	Lining engine box	16 14 8	6 6 11	4 3 8	27 5 3
456	„	„ „	16 14 8	6 6 11	4 3 8	27 5 3
457	„	Bogie and cow-catcher repaired, damaged in Sydney yard	29 18 10	2 6 2	7 7 3	39 12 3
		Lining engine boxes	16 14 8	6 6 11	4 3 8	27 5 3
			306 14 1	77 1 7	71 11 6	455 7 2
Less cost of repairs thorough collisions and derailments, and not due to faulty workmanship. No. 450			£14 5 11	60 17 11	4 19 4	13 12 7
No. 449			65 3 11			79 9 10
			245 16 2	72 2 3	57 18 11	375 7 4

TWELVE BALDWIN PASSENGER.
Shop Repairs.

Numbers and Cost of each.													
	446.	447.	448.	449.	450.	451.	452.	453.	454.	455.	456.	457.	Total.
Eveleigh Shops	£ s. d. 27 5 3	£ s. d. 27 5 3	£ s. d. 27 5 3	£ s. d. 92 9 2	£ s. d. 69 10 6	£ s. d. 27 5 3	£ s. d. 27 5 3	£ s. d. 27 5 3	£ s. d. 8 8 0	£ s. d. 27 5 3	£ s. d. 27 5 3	£ s. d. 66 17 6	£ s. d. 446 19 2 8 8 0
Do Running Shed
Penrith
Bathurst
Nyngan
Pictou
Goulburn
Harden
June
Newcastle
Murrumbidgee
Armidale
Total	£ 27 5 3	£ 27 5 3	£ 27 5 3	£ 92 9 2	£ 69 10 6	£ 27 5 3	£ 27 5 3	£ 27 5 3	£ 8 8 0	£ 27 5 3	£ 27 5 3	£ 66 17 6	£ 455 7 2

Running Repairs.

Eveleigh Shops	15 18 9	8 1 4	12 1 9	15 16 3	6 1 0	13 4 8	4 0 10	6 5 10	7 4 0	7 2 7	8 19 11	18 1 1	122 18 0
Do Running Shed	1 1 3	.....	1 8 0	8 13 2	3 5 5	7 0 7	1 9 0	4 0 0	1 5 3	3 6 3	12 6 9	3 9 7	34 12 1
Penrith	17 7 8	19 1 3	14 19 3	4 4 8	20 12 3	.....	13 12 6	4 0 0	13 4 2	12 7 1	.....	21 2 5	144 19 9
Bathurst	10 6 6	14 4 8	.....	0 4 10	.....	.....	0 3 4	13 5 8	.....	1 8 8	.....	0 19 4	44 12 10
Nyngan .....	.....	.....	5 2 4	9 5 6	.....	4 19 5	6 12 6	4 10 9	3 19 7	6 13 4	5 11 6	.....	0 4 10
Pictou .....	.....	.....	.....	.....	.....	.....	8 7 7	5 14 6	.....	.....	16 15 1	.....	46 14 11
Goulburn .....	.....	.....	4 15 7	.....	8 7 6	7 17 5	.....	2 12 9	3 17 8	4 15 9	.....	7 19 7	30 17 2
Harden .....	.....	.....	1 4 10	.....	.....	.....	.....	.....	0 18 1	.....	.....	.....	46 5 3
June	5 19 0	.....	.....	.....	.....	.....	.....	.....	7 14 10	.....	.....	.....	21 2 11
Newcastle .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7 14 10
Murrumbidgee .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Armidale .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	£ 50 13 2	£ 41 7 3	£ 39 11 9	£ 38 4 5	£ 38 6 2	£ 33 2 1	£ 34 5 9	£ 36 9 6	£ 38 3 7	£ 35 13 8	£ 43 13 3	£ 51 12 0	£ 481 2 7

ALTERATIONS, &c., debited to the Department.—20 Consolidation Engines.

No. of order.	Date issued.	Particulars of work.	Date of completion.	Expenditure to 11th February, 1892.	Expenditure from 11th February, 1892, to 27th March, 1892.	Total expenditures to 27th March, 1892.
3,344	22/9/91	Fitting lamps and irons, also coal boards	3/12/91	£ s. d. 34 10 10	£ s. d.	£ s. d. 34 10 10
3,386	6/10/91	Fitting one additional water gauge, and carrying main air-pipe to front .....	.....	81 6 5	4 7 9	85 14 2
T 43	21/9/91	Repairing tender bogie hook, two diagonal stays, and arm of tender brake-shaft	3/12/91	27 14 4	.....	27 14 4
3,327	16/9/91	Fitting hand-rails to tenders, and making 20 wrenches for oil cups	28/1/92	38 2 3	.....	38 2 3
3,367	30/9/91	Fixing two foot-boards to each engine	3/12/91	22 14 2	.....	22 14 2
3,496	2/12/91	Alterations to bolt in large end of connecting rod .....	.....	1 10 6	.....	1 10 6
3,350	24/9/91	Shield plates for fire door-rings	28/1/92	6 5 2	.....	6 5 2
3,376	2/10/91	Making frames for notices in cabs .....	.....	1 11 8	.....	1 11 8
3,424	29/10/91	Strainers in manholes of tanks	28/1/92	20 6 9	.....	20 6 9
3,578	27/1/92	Alterations to engine brake-shoes	25/2/92	2 18 11	4 17 9	7 16 8
3,594	1/2/92	Alterations to reversing gear .....	.....	.....	18 18 4	18 18 4
3,652	3/3/92	Providing additional water carrying capacity, tender No. 497 .....	.....	.....	75 13 5	75 13 5
				£ 237 1 0	103 17 3	340 18 3

SHOP Repairs to 20 Consolidation Engines.

No. of engine.	Where repaired.	Details of repairs.	Wages.	Stores.	Charges.	Total.
483	Bathurst	Repairing damage caused by collision at Kerr's Creek..	£ s. d. 64 2 8	£ s. d. 0 13 0	£ s. d. 14 2 11	£ s. d. 78 18 7
486	Eveleigh	Firebox examined, and leading tire lined up	10 11 8	1 2 1	2 12 3	14 6 0
488	Eveleigh	Firebox examined, tubes repaired, and stays caulked...	11 0 4	1 12 2	2 14 2	15 6 8
492	Bathurst	Extensive repairs caused by engine being in collision...	27 2 0	.....	.....	27 2 0
498	Eveleigh	Ash-pan taken down ; 230 ferrules taken out at firebox end ; 7 tubes taken out and brazed, tubes fitted ; all tubes expanded and ferruled both ends ; 257 crown stays caulked ; seams of copper tube plate caulked	16 18 2	1 1 10	4 4 6	22 4 6
501	Eveleigh	Left cylinder repaired, damaged by collision at Eveleigh coal stage	68 0 6	7 10 9	17 0 1	92 11 4
			197 15 4	11 19 10	40 13 11	250 9 1
Less cost of repairs through collisions and derailments, and not due to faulty workmanship.			No. of engine.	Amount.		
			£ s. d.			
			483	78 18 7		
			492	27 2 0		
			501	92 11 4		
			159 5 2	8 3 9	31 3 0	198 11 11
			£ 38 10 2	3 16 1	9 10 11	51 17 2

TWENTY CONSOLIDATION.
Shop Repairs.

Numbers and Cost of each Engine.

	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	Total.
Eveleigh Shops	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
" R'g Shed	.....	.....	.....	14 6 0	.....	15 6 8	.....	.....	.....	.....	.....	.....	.....	.....	.....	22 4 6	.....	.....	92 11 4	.....	144 8 6
Penrith	78 18 7	.....	.....	.....	.....	.....	.....	.....	.....	27 2 0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	106 0 7
Bathurst	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Nyngan	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pictou	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Goulburn	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Harden	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Junee	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Newcastle	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Murrumbidgee	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Armidale	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	£78 18 7	.....	.....	14 6 0	.....	15 6 8	.....	.....	.....	27 2 0	.....	.....	.....	.....	.....	22 4 6	.....	.....	92 11 4	.....	250 9 1

Running Repairs.

	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	Total.
Eveleigh Shops	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
" R'g Shed	.....	.....	.....	.....	1 0 4	1 3 0	0 5 6	.....	0 4 0	.....	4 8 16	3 1 6	5 19 8	0 0 4	0 2 8	1 3 8	0 0 8	1 4 4	.....	7 17 1	22 2 9
Penrith	0 16 0	47 0 10	20 6 9	4 8 0	29 9 4	27 0 1	9 8 7	6 13 11	25 17 6	1 16 4	8 16 8	0 4 3	1 5 6	1 13 8	31 5 5	11 0 6	9 0 2	5 6 1	9 1 4	12 10 5	316 9 7
Bathurst	.....	7 11 0	24 11 6	21 3 7	2 5 7	4 16 0	28 18 10	26 8 5	2 3 0	29 8 2	13 17 8	26 8 7	23 6 7	42 8 1	17 8 1	16 5 1	15 7 0	13 0 1	15 9 1	14 0 2	280 9 9
Nyngan	1 10 0	.....	.....	0 10 0	.....	.....	1 14 0	0 10 8	.....	0 12 8	.....	0 5 4	1 6 4	0 2 8	.....	.....	.....	.....	.....	.....	6 11 8
Pictou	.....	.....	.....	.....	.....	.....	.....	10 9 4	.....	.....	.....	0 4 5	8 7 5	.....	.....	.....	.....	.....	.....	.....	19 1 2
Goulburn	.....	.....	.....	.....	.....	.....	.....	4 0 8	.....	.....	6 17 6	.....	6 19 10	.....	.....	.....	.....	.....	.....	.....	11 0 6
Harden	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6 17 6
Junee	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Newcastle	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Murrumbidgee	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Armidale	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	£2 6 0	54 11 10	44 18 3	26 1 7	32 15 3	32 19 1	40 6 11	48 3 0	28 4 6	31 17 2	29 11 10	30 4 1	47 5 1	44 5 7	32 5 9	28 10 1	43 5 3	23 2 10	19 17 1	22 1 6	662 12 11

TEN DUBS ENGINES.
Shop Repairs.

Where Repaired.	Number and Cost of each, to 31st December, 1890.										Total Cost.	Average Cost per Engine.
	436.	437.	438.	439.	440.	441.	442.	443.	444.	445.		
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Eveleigh Shops	34 6 9	34 3 9	36 11 3	.....	92 4 0	27 4 8	34 8 6	.....	30 0 4	28 0 4	316 19 7	31 13 11

Running Repairs.

	436.	437.	438.	439.	440.	441.	442.	443.	444.	445.	
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Eveleigh Shops	13 8 6	4 16 10	8 2 0	4 12 1	7 5 8	4 0 2	4 0 2	4 5 2	4 0 2	7 7 9	61 18 6
Do Running Sheds	16 8 2	10 13 5	18 18 7	26 13 10	25 10 8	28 13 8	15 18 8	28 14 8	27 17 9	26 1 1	225 10 6
Penrith	1 8 6	7 3 1	5 10 2	5 1 10	1 11 2	.....	.....	.....	.....	0 6 3	21 1 0
Bathurst	13 10 8	16 13 0	34 0 2	.....	12 11 11	.....	21 10 11	0 9 9	.....	7 6 9	106 3 2
Nyngan .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Picton .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Goulburn	1 0 6	.....	.....	0 6 6	.....	0 12 9	.....	.....	0 10 9	0 4	2 14 6
Harden .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
June .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Newcastle .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Murrumbidgee .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Armidale .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	£ 45 16 4	39 6 4	66 10 11	36 14 3	46 19 5	33 6 7	41 9 9	33 9 7	32 8 8	41 5 10	417 7 8
											41 14 9

Return of Broken Rails on Portion of Western Line.

Sir,

Government Railways of New South Wales,
Secretary's Office, Sydney, 21st June, 1892.

In accordance with the request of your Commission, conveyed in your letter of the 13th instant, I am directed by the Railway Commissioners to forward herein information with reference to the number of broken rails prior to the introduction of the Baldwin engines, and since they have been regularly running on the Western Line, say from 1st November, 1891.

With respect to the section of line between Penrith and Bathurst it will be seen that on the most difficult part of the line, viz., between 34 miles and 114 miles, only one rail has been broken in the three years, and that before the Baldwin engines arrived; whilst between 127 miles and 143 miles three rails were broken before and only one since these engines were introduced, although the road is growing gradually older. With these exceptions, the whole of the breakages, Penrith to Bathurst, have occurred between 114 miles and 127 miles. On this section the rails are chiefly 75lb. iron rails, approaching the period of exhaustion. This portion of the line has been for some time past under extensive renewal, and within a short period the whole of the old rails will be replaced with new steel rails.

The result of the running of the Baldwin engines can be better gauged—so far as broken rails extend—by the experience with the 71½lb. steel rails, between Bathurst and Dubbo, as shown on the returns submitted.

For easy reference I forward attached sketches showing the broken rails for each period, with the mileage, &c.

I have to regret that there has been some little delay in preparing the information, but the returns available did not clearly indicate which were broken rails, and inquiry had to be made in each case to ascertain facts, the returns which it had been usual to submit including rails which showed flaws, &c. It is the practice in the Existing Lines Branch to take out any rail which may show any defect, no matter how slight, in the way of flaw or fracture, and to submit such in a return of broken rails. It may, however, be possible for a flaw or fracture to exist in a rail for months, or even years, and of late rather more flawed rails have been detected than was previously the case. This is largely due to the fact that so much has been done in the way of re-ballasting, re-sleepering, and lifting, and by this means faults which may have been unnoticed or covered up by ballast for some time have been detected after the opening up of the road.

Where the rails have broken between 115 miles 32 chains and 118 miles 75 chains (16 per cent. of the whole), the rails weighed 75 lb. per yard, chairs 27 lb. each in weight, and the ironbark sleepers, in the majority of instances, were closely spaced.

I have, &c.,
H. McLACHLAN,
Secretary.

The Secretary, Royal Commission, Baldwin Engines.

GREAT WESTERN RAILWAY—Statement showing Broken Rails.

Nearest Station.	Distance.	Date broken.	Original weight per yard.	Description—Steel or Iron.	Brand.	Date laid in.	Spacing sleepers.	Remarks.
Millthorpe....	m. c. 176 75	19 Dec., 1889	lb. 71½	Steel	B. V. & Co.	Feb., 1889	..	Old flaw 8 feet from end.
Orange	190 36	19 " 1889	71½	"	West Cumbld. N.S.W.G. VIII..	1887	..	" 2 " "
Locksley	127 30	18 Feb., 1890	75	Iron	Parkgate	1873	..	Flaw in rail. "
Driptonstone	238 50	9 Mar., 1890	71½	Steel	S.J.G. IX.77	1880	..	Existing flaw.
"	239 0	5 " 1890	71½	"	Dowlais 1.77	1880	..	"
Locksley	126 40	20 April, 1890	75	Iron	B. V. & Co.	1872	..	"
Store Creek ..	222 75	20 " 1890	71½	Steel	Dowlais 11.77	1880	..	Broken on edge of punched hole when spiking back.
Wellington ..	240 20	30 June, 1890	71½	"	S.J.G. 77	1880	..	Broken where hole had been punched.
Geurie	259 40	9 July, 1890	71½	"	"	1880	..	"
Mary Vale	250 0	10 " 1890	71½	"	Dowlais 2.77	1880	..	Existing flaw. "
Tarana	121 50	8 Aug., 1890	75	Iron	Parkgate	1872	..	"
Blayney	169 63	23 " 1890	71½	Steel	B. V. & Co. 11.80	1881	..	A clean break.
"	175 41	23 " 1890	71½	"	"	1884	..	Flaw in flange.
Spring Hill ..	184 30	2 Sept., 1890	71½	"	Darlington	1886	..	"
Locksley	129 63	15 " 1890	75	Iron	Milton May	1874	..	An old flaw.
Huntley	189 73	23 Oct., 1890	71½	Steel	West Cumberland	1886	..	Broken where punched.
Orange	197 0	25 " 1890	71½	"	Dowlais 77	1880	..	A clean break.
Tarana	118 0	26 " 1890	75	Iron	B. V. & W. P.	1871	..	Flaw in rail.
Rydal	114 5	27 Nov., 1890	75	"	"	1872	..	Broken in centre; no flaw.
Millthorpe....	181 42	7 " 1890	71½	Steel	West Cumberland	1886	..	An old flaw.
Blayney	172 2	3 " 1890	71½	"	Darlington	1888	..	"
Rydal	114 65	1 " 1890	75	Iron	Parkgate	1872	..	"
Driptonstone ..	241 30	14 Dec., 1890	71½	Steel	S.J.C. 77	1880	..	Existing flaw.
Blayney	175 13	18 Jan., 1891	71½	"	B. V. & Co.	1881	3 0	Clean break, 4 feet from end.
Locksley	125 70	27 " 1891	75	Iron	Parkgate	1872	3 0	Old flaw, 4 feet from end.
"	125 70	14 Feb., 1891	75	"	"	1872	3 0	" 4 feet "
"	126 38	2 April, 1891	75	"	B. V. & W. P.	1888	3 0	Clean break, 3 feet from end.
Millthorpe....	181 62	14 May, 1890	71½	Steel	West Cumberland	1885	3 0	" 2 ft. 2 in. from end.
Apsley	244 57	10 June, 1891	71½	"	S.J.C. 9.77	1880	3 0	Old flaw, broken in centre.
Mumbil	235 0	13 July, 1891	71½	"	S.J.C. IX.77	1880	3 0	Existing flaw, 4 ft. 9 in. from en l.
Locksley	125 03	21 Aug., 1891	80	"	Cannell Sheffield toughened steel.	1891	3 0	Old flaw, 5½ inches from end.
Millthorpe....	179 60	31 " 1891	71½	"	West Cumberland	1891	3 0	New break, 2 ft. 10 in. from end.
Orange	195 0	8 Sept., 1891	71½	"	Dowlais XI.7	1880	3 0	Broken in middle.
Bowenfels	98 56	17 " 1891	75	Iron	B. V. & W. P.	1870	3 0	" fish-plate hole, 6 inches from end.
Warne	215 0	1 Oct., 1891	71½	Steel	Dowlais XII.77	1880	3 0	" middle.
Tarana	121 55	20 " 1891	75	Iron	Parkgate	1876	3 0	New breaks, 8 feet and 1 ft. 6 in. from end.
Locksley	130 6	21 " 1891	75	"	"	1874	3 0	Old flaw, 6 ft. 8 in. from end.
Orange	196 0	13 Nov., 1891	71½	Steel	S.J.G. 77	1878	3 0	Existing flaw, 14 inches from end.
Tarana	117 8	19 " 1891	75	Iron	L.W. & B.	1875	3 0	Clean break, 2 feet from end.
"	118 80	1 Dec., 1891	75	"	Parkgate	1870	3 0	New break, 8 " "
Orange	196 0	9 " 1891	71½	Steel	S.J.G. 77	1886	3 0	Old flaw, 16 " "
Tarana	117 50	12 " 1891	75	Iron	Parkgate	1881	2 4	Clean break, 7 ft. 7 in. from end.
"	115 32	9 Jan., 1892	75	"	"	1875	2 5	" 7 ft. 6 in. "
"	117 43	16 " 1892	75	"	"	1879	2 5	" 8 feet "
"	118 75	16 " 1892	75	"	"	1880	2 4½	" 1 ft. 3 in. "
Orange	197 0	28 " 1892	71½	Steel	Dowlais 77	1880	2 5	" 4 ft. 7½ in. "
Kerr's Creek ..	207 20	12 Feb., 1892	71½	"	Dowlais XII	1881	3 1	" 2 ft. 8 in. "
Mumbil	237 0	7 April, 1892	71½	"	Dowlais X.77	1881	3 1	Old flaw, 8 ft. 6 in. from end.
Brewongle	132 14	21 " 1892	75	Iron	Parkgate	1883	2 4	" 1 ft. 8 in. "
Tarana	117 14	27 " 1892	75	"	"	1892	2 10	Clean break, 3 ft. 4 in. from end.

* A second rail was broken at this place owing to first accident.

Messrs. Kidd and Pollock's Report on Trial of American 10-wheel Passenger Engine.
 To the Commissioners of Railways,—
 Gentlemen,

Sydney, 21 May, 1892.

In compliance with your request we made a series of careful trials on May 15th, with the ten-wheeled Baldwin engine, No. 447, to ascertain accurately the performance of the engine when hauling passenger vehicles up grades of 1-30 and 1-40, and have the honour to submit the following report.

The trials were made on a part of the line between Picton and Hill Top. The train was made up of Pullman sleeping cars and first-class lavatory carriages, and in every case weighed somewhat more than the stipulated loads. The Pullman sleeping cars were carried on six-wheeled trucks or bogies, and all the remaining passenger vehicles on four-wheeled bogies. All these wheels were 3 feet diameter.

The general dimensions of the engine are as follows:—

Diameter of cylinder	...	...	...	...	21"
Stroke	...	...	...	...	24"
Diameter of drivers	...	...	...	...	61"
Area of fire-grate	...	...	...	...	27·7 square feet.
„ H. S. in fire-box (copper)	...	...	...	...	105·6
„ „ tubes (brass)	...	...	...	...	1,822·5
Total	...	...	...	...	1,928·1

Tractive force per lb. of M. E. P. per square inch = 171·0 lb.*
 Maximum boiler pressure „ „ „ 160 lb.

Total weight of engine in running order, with $\frac{3}{4}$ glass
 of cold water and sand-boxes full—

Weight on driving wheels	...	...	...	...	Tons cwt.
„ bogie „	...	...	...	...	43 11
					14 16
Total weight of engine	...	...	...	...	58 7
Weight of tender empty	...	...	...	...	Tons cwt.
„ 3,000 gallons water	...	...	...	...	13 12
„ 5 tons coal	...	...	...	...	13 8
					5 0
Maximum weight of tender	...	...	...	...	32 0

Maximum weight in running order, engine and tender ... 90 7

The weight of the train was ascertained by weighing each vehicle on the previous day on an accurate weighbridge at Eveleigh. An addition varying from 2 tons to 1 ton 15 cwt. was made for the weight of the passengers carried.

The incline of 1-40 on which the trials No. 1, 2, and 5, were made, was $2\frac{1}{2}$ miles long, and there were four curves of 16 chains (1,056 feet) radius on the first mile.

The incline of 1-30 on which the trials 3 and 4 were made, was about 2 miles long, having at the foot an incline of 1-33. The trials were made on the combined length $2\frac{3}{4}$ miles of these gradients.

The position of these inclines is shown on the accompanying section. The train approached the foot of these gradients at about the speed usual in ordinary running.

The weather was fine with a dry rail, and no slipping was observed throughout the trials.

The full train (179 tons 5 cwt.) was run from Sydney to Campbelltown by one engine, but two engines of the English express type (four wheels coupled with inside cylinders) were required to haul the train from Campbelltown to Picton over the 1-70 gradients between these points. It is noteworthy that the ten-wheeled Baldwin engine then took the same train unassisted over the 1-40 gradients between Picton and Picton Lakes, thus very clearly demonstrating its superior power.

The first trial was made with a load of 179 tons 5 cwt. up a grade of 1-40. The indicated horse power developed and tractive force exerted during the trial being as follows:—

TABLE I.
 First test up 1-40, May 15th, 1892.

	Tons cwt. qr.
Actual load, exclusive of engine and tender	179 5 2
Stipulated load, as per letter to Baldwin Works, September 22, 1890.....	176 0 0
Excess of actual over stipulated load	3 5 2

No. indicator card.	Mile-post where taken.	Speed in miles per hour.	Boiler pressure.	Initial pressure.	M.E.P.	I.H.P.	Tractive power.	Resistance in lb. per ton of whole train
			lb.		lb.		lb.	
1	54 $\frac{1}{8}$	31·	155	139·5	63·4	996·	10,841	15·79
2	54 $\frac{5}{8}$	22·	155	139·5	95·6	959·	16,347	4·62
3	54 $\frac{7}{8}$	19·56	155	144·	103·4	922·	17,681	9·51
4	55 $\frac{1}{8}$	17·47	150	140·	105.	838·	17,955	10·59
5	55 $\frac{5}{8}$	17·64	150	138·	102·8	826·	17,578	9·18
6	55 $\frac{7}{8}$	17·	147	137·	105·5	817.	18,040	10·9
7	56 $\frac{1}{8}$	15·93	140	134·	102·	740·9	17,442	8·78
8	56 $\frac{5}{8}$	15·79	135	127 5	101·	728·	17,271	8·05

* Allowing a deduction for the area of the piston-rod. Without this deduction, the tractive co-efficient is 173·5 lb.

The accompanying tables give an analysis of the performance of the engine during the trials. It will be seen that the boiler pressure was better maintained on the 1-30 than on the 1-40 gradient. This is probably attributable wholly to the difference in the condition of the fire. The engine commenced the ascent of the 1-40 gradient after running down hill slowly tender first, and standing for some time at Picton. The fire thus became partially dead, and was not thoroughly ignited in the short distance run before reaching the gradient. In ordinary working this would not occur, as the firemen usually take the opportunity of building up the fire and getting it in good condition for rapid steaming when approaching a heavy gradient.

The engine approached the 1-30 gradient after having run for some miles on slightly-rising gradients, the blast had consequently thoroughly ignited the fire, and the engine maintained steam, and in some cases showed an increase of speed and tractive power towards the summit. Had the engine been running the regular mail or express trains she would have approached the 1-40 gradient under the same condition, and would doubtless have carried a higher pressure, and obtained a higher speed, especially on the trial with a load of 157 tons up 1-40.

The distance run on the trials was 21 miles 10 chains.

The coal used was (Metropolitan) of fair quality, and the total amount burned 91 cwt. 2 qrs. 21 lb. = 82·38 lb. per mile.

TABLE II.

Second test up, 1-40.

	Tons cwt. qrs.
Actual load, exclusive of engine and tender	157 12 2
Stipulated load as per letter to the Baldwin Works, September 22, 1890	152 0 0
Excess of actual over stipulated load	5 12 2

No. indicator card.	Mile-post where taken.	Speed in miles per hour.	Boiler pressure.	Initial pressure.	M.E.P.	I.H.P.	Tractive power.	Resistance in lb. per ton of whole train
			lb.	lb.	lb.	lb.	lb.	
9	54½	20·8	155	141·5	56·8	772	9,712	- 16·8
10	54¾	21·43	150	139·	79·4	776	13,577	- 1·09
11	54¾	19·147	145	134·	91·7	801	15,680	+ 7·22
12	55	18·75	145	136·	94·7	808	16,193	9·3
13	55¾	18·55	150	138·5	101·12	855	17,291	13·7
14	55¾	18·75	150	139·	95·4	815	16,313	9·77
15	56½	19·35	150	138·	98·43	872	16,329	11·859

TABLE III.

Third Test, up 1-33 and 1-30.

	Tons. cwt. qr.
Actual load, exclusive of engine and tender	121 19 2
Stipulated load as per letter to Baldwin Works, September 22, 1890	120 0 0
Excess of actual over stipulated load	1 19 2

No. of indicator card.	Mile-post where taken.	Speed in miles per hour.	Boiler pressure.	Initial pressure.	M.E.P.	I.H.P.	Tractive power.	Resistance in lb per ton of whole train
Grade, 1-33.								
			lb.	lb.	lb.	lb.	lb.	
16	65¾	30·5	160	143	58·4	812	9,986	20·85
17	66½	26·08	160	147	85·55	1017·3	14,629	+ 1·01
18	66¾	21·95	150	140	92·5	925·6	15,817	6·6
Grade, 1-30.								
19	66	20·45	155	142	97·85	912·0	16,732	4·12
20	67	17·64	155	144	107·5	864·7	18,382	11·8
21	67¾	17·45	160	144	106·6	849·8	18,228	11·17
22	67¾	16·82	155	145	109·7	841·8	18,758	13·6
23	68½	17·47	155	142	108·4	863·5	18,536	12·6
24	68¾	18·18	150	136	103·8	860	17,749	8·9

TABLE IV.

Fourth Test up 1-33 and 1-30.

Actual load, exclusive of engine and tender	Tons.	cwt.	qrs.
Stipulated load as per letter to Baldwin Works, September 22, 1890	144	2	2
	144	0	0

Excess of actual over stipulated load 0 2 2

No. of indicator card.	Mile-post where taken.	Speed in miles per hour.	Boiler pressure.	Initial pressure.	M.E.H.	I.H.P.	Tractive Power.	Resistance in lb. per ton of Whole Train.
<i>Grade, 1-33.</i>								
25	65 $\frac{7}{8}$	31.57	lb. 160	lb. 138.5	lb. 61	lb. 878	lb. 10,431	- 23.1
26	66 $\frac{1}{8}$	25.35	155	141.5	89.1	1,029	15,236	- 2.12
27	66 $\frac{1}{2}$	19.56	155	141.0	95.35	850	16,304	+ 1.9
28	66 $\frac{3}{8}$	18.75	155	143.5	104.8	896	17,920	8.8
<i>Grade, 1-30.</i>								
29	66 $\frac{5}{8}$	16.82	155	144	112	860	19,152	7.4
30	67 $\frac{1}{8}$	15.38	155	145	116	815	19,836	10.3
31	67 $\frac{5}{8}$	15.65	.....	145	113	807	19,323	8.73
32	67 $\frac{7}{8}$	14.87	155	145.5	114.3	774.5	19,545	8.22
33	68 $\frac{1}{8}$	14.81	160	140	112.5	750	19,237	7.7
34	68 $\frac{1}{2}$	14.062	150	145.5	113.9	730.3	19,476	8.7
35	68 $\frac{3}{8}$	14.4	155	146	114.9	754.5	19,647	9.32
36	68 $\frac{1}{2}$	14.7	145	137.5	112.85	756.4	19,297	8.00

TABLE V.

Fifth Test, up 1-40.

Actual load, exclusive of engine and tender	Tons	cwt.	qrs.
Stipulated load as per letter to Baldwin works, 22 September, 1890	157	12	2
	152	0	0

Excess of actual over stipulated load 5 12 2

No. of Indicator Card.	Mile-post where taken.	Speed in miles per hour.	Boiler pressure.	Initial pressure.	M.E.P.	I.H.P.	Tractive power.	Resistance in lbs. per ton of whole train.
37	54 $\frac{1}{8}$	31.00	155	141.5	lb. 54.90	776.0	lb. 9,387	18.15
38	54 $\frac{3}{8}$	26.86	150	140.0	77.90	954.0	13,320	2.29
39	54	20.93	150	136.0	93.20	889.0	15,937	8.26
40	54 $\frac{7}{8}$	21.17	150	136.5	91.80	866.0	15,697	7.29
41	55 $\frac{1}{8}$	19.56	155	139.0	96.70	862.0	16,535	10.67
42	55 $\frac{3}{8}$	20.22	155	139.5	99.80	920.0	17,065	12.81
43	55 $\frac{5}{8}$	19.78	150	135.0	97.15	870.0	16,612	10.98
44	56 $\frac{1}{8}$	20.00	145	130.0	97.00	884.6	16,587	10.88
45	56 $\frac{3}{8}$	20.93	140	118.5	88.46	844.0	15,126	4.99

The indicator diagrams were taken by means of a "Crosby" indicator. The L.H. diagrams are from the front end of the cylinder, and the R.H. diagrams from the back. The pipes connecting the cylinder ends and the indicator were of copper 1 in. diameter, reduced to $\frac{3}{8}$ in. where they joined the breeches piece. They were carefully lagged with asbestos and spun yarn. We regret that the position and design of the cylinder necessitated these pipes being so long, viz., about 4 ft. 11 in. at the front end, and 5 ft. 6 in. at the back, and we are of opinion that an allowance of 5 per cent. should be added to the mean pressure indicated on the cards to allow for friction and condensation. In support of our opinion we would refer to some trials reported in the proceedings of the Institute of Mechanical Engineers, England, January, 1890, in which 10 per cent. was considered a fair allowance, and in this case the pipes were only 3 ft. long, as against 5 ft. long.

On the evening previous to the trials we rode on the engine from Picton to Campbelltown, attaining a speed of about 45 miles per hour. The engine ran very steadily and took the curves very smoothly, there being a noticeable absence of shock on entering the curves.

In conclusion we would observe that we consider the engines to be very satisfactory in design and workmanship, while the haulage power and steadiness in running leave nothing to be desired.

We would further observe that the maximum tractive power obtained on the trial of 1-30, viz., 19,836 lb., exceeded the maximum recorded in the trial of the Baltimore and Ohio engine (viz., 19,064 lb.), which is nearly 4 tons heavier, and has larger heating surface and cylinder capacity.

We beg to enclose four packages, containing in all forty-five indicator cards, being the originals taken during each test.

We have, &c.,

HECTOR KIDD, A.M.I.C.E., M.I.M.E.

ROBT. POLLOCK,

President, Engineering Association.

Measurements of Platforms showing clearance.

THE following shows the measurement from centre of cylinder to top of platforms, Homebush to Bathurst ; also measurement from gauge fixed on cab to outer edge of station verandahs.

	Cylinders.		Outer edge of gauge to top of platform.		Cab.			Cylinders.		Outer edge of gauge to top of platform.		Cab	
	C. of cylinder to top of platform.				Edge of gauge to verandah.			C. of Cylinder to top of platform.				Edge of gauge to verandah	
	C.	F.	C.	F.	C.	F.		C.	F.	C.	F.	C.	F.
	in.	in.	in.	in.	in.	in.		in.	in.	in.	in.	in.	in.
Homebush	14 $\frac{1}{8}$	1	1	1	Clear	...	Hazelbrook	17 $\frac{1}{8}$	...	4	...	Clear	...
Granville.....	14 $\frac{3}{8}$	$\frac{1}{8}$	...	...	...	...	Lawson	15 $\frac{1}{8}$	...	2	...	"	...
Parramatta	16 $\frac{1}{8}$	...	1 $\frac{1}{2}$	$\frac{1}{2}$	...	1	Wentworth Falls	15 $\frac{1}{8}$	...	3	...	...	1
Parramatta Park	14 $\frac{1}{8}$	1	1	1	Clear	...	Katoomba	17 $\frac{1}{8}$	...	4	...	Clear	...
Westmead	16 $\frac{3}{8}$	...	3 $\frac{1}{2}$	...	"	...	Medlow.....	16 $\frac{5}{8}$	...	3 $\frac{1}{2}$	...	"	...
Wentworthville ...	15 $\frac{5}{8}$	...	2 $\frac{1}{2}$	...	"	...	Blackheath	17 $\frac{1}{8}$	...	4	...	"	...
Toongabbie	17 $\frac{1}{8}$	...	4 $\frac{1}{2}$	...	"	...	Mount Victoria	14 $\frac{5}{8}$	$\frac{1}{2}$	1 $\frac{1}{2}$	$\frac{1}{2}$	"	...
Seven Hills	15 $\frac{1}{8}$	...	2	...	"	...	Hartley Vale Sg.	18 $\frac{1}{8}$	...	5	...	"	...
Blacktown	16 $\frac{1}{8}$	...	3	...	"	...	Bell	14 $\frac{3}{8}$	$\frac{3}{4}$	1 $\frac{1}{4}$	$\frac{3}{4}$	"	...
Doonside.....	16 $\frac{1}{8}$	...	3	...	"	...	Clarence Siding..	15 $\frac{5}{8}$	...	2 $\frac{1}{2}$	...	"	...
Rooty Hill	16 $\frac{1}{8}$	...	3	...	"	...	Zigzag B. Points	15 $\frac{5}{8}$	...	2 $\frac{1}{2}$	...	"	...
Mount Druitt.....	16 $\frac{5}{8}$	...	3 $\frac{1}{2}$	...	"	...	Eskbank Coal Sg.	Clear	Clear	...	...	"	...
St. Mary's	16 $\frac{1}{8}$	...	3	...	"	...	Eskbank	16 $\frac{1}{8}$	...	3	...	"	...
Parkes Platform	14 $\frac{1}{8}$	1	1	1	"	...	Lithgow	16 $\frac{5}{8}$	...	3 $\frac{1}{2}$	...	"	...
Kingswood	14 $\frac{5}{8}$	$\frac{1}{2}$	1 $\frac{1}{2}$	$\frac{1}{2}$	"	...	Bowenfels	16 $\frac{5}{8}$	...	3 $\frac{1}{2}$	...	"	...
Penrith	16 $\frac{1}{8}$	...	3	...	3	...	Marrangaroo.....	18 $\frac{1}{8}$	...	5	...	"	...
Emu Plains	16 $\frac{1}{8}$	...	3	...	Clear	...	Wallerawang ...	16 $\frac{1}{8}$	...	3	...	"	1 $\frac{1}{2}$
Lucasville	19 $\frac{1}{8}$	...	6	...	"	...	Rydal	16 $\frac{1}{8}$	...	3	...	"	...
Glenbrook	15 $\frac{5}{8}$	...	2 $\frac{1}{2}$	...	"	...	Sodwalls	15 $\frac{1}{8}$	...	2	...	"	...
Blaxland	16 $\frac{1}{8}$	...	3	...	"	...	Tarana	17 $\frac{1}{8}$	...	4	...	"	...
Karabar	16 $\frac{1}{8}$	..	3	...	"	...	Locksley	17 $\frac{1}{8}$	...	4	...	"	...
Valley Heights ...	16 $\frac{5}{8}$	...	3 $\frac{1}{2}$	...	"	...	Brewongle	16 $\frac{7}{8}$	...	3 $\frac{3}{4}$	...	"	...
Springwood	19 $\frac{1}{8}$	...	6	...	"	...	Raglan	15 $\frac{5}{8}$	...	2 $\frac{1}{2}$	...	"	...
Faulconbridge ...	18 $\frac{7}{8}$	...	5 $\frac{3}{4}$	...	"	...	Kelso.....	16 $\frac{5}{8}$	...	3 $\frac{1}{2}$	...	"	...
Linden	16 $\frac{1}{8}$	...	3	...	"	...	Bathurst	16 $\frac{1}{8}$	...	3	...	"	...
Woodford	16 $\frac{1}{8}$	...	3	...	"	...							

Sir,

When testing the clearance at the Bathurst coal-stage, I find the bottom of the woodwork fouls the gauges over the top of the cab 11 $\frac{1}{4}$ inches at west end, and 10 $\frac{3}{4}$ inches there is quite sufficient clearance at the side of cab and cylinders. Bathurst platform on the down line is only 2 $\frac{3}{4}$ inches; Mullion Creek platform is only 1 $\frac{1}{2}$ from outer edge of gauge to top of platform; all the other platforms between Bathurst and Dubbo are all over 3 inches clear. All the verandahs are well clear except Orange, and the cab-gauge touches the facing-boards at the ends of the verandah. This station I will measure again on the return journey at every point. The measurement from rail to top of gauge on cab is 12 feet 6 inches—that shown on sketch 12 feet 3 inches.

J. GREGORY,
29/7/91.

Mr. Stanger.

Sir,

I have tested the clearance of all platforms and verandahs west of Bathurst, both on up and down journey. The platforms that were a little too close on the down journey have been altered; not any of them are now under 16 $\frac{1}{4}$ inches from centre of cylinder to top of platform. All the verandahs are well clear except Orange, and when approaching the verandah the gauge caught the facing-boards at each end, owing to them projecting out; the one at the west end knocked the top corner of the gauge down about 1 $\frac{1}{2}$ inches. The water-pipes are only 1 inch from the outer edge of the gauge.

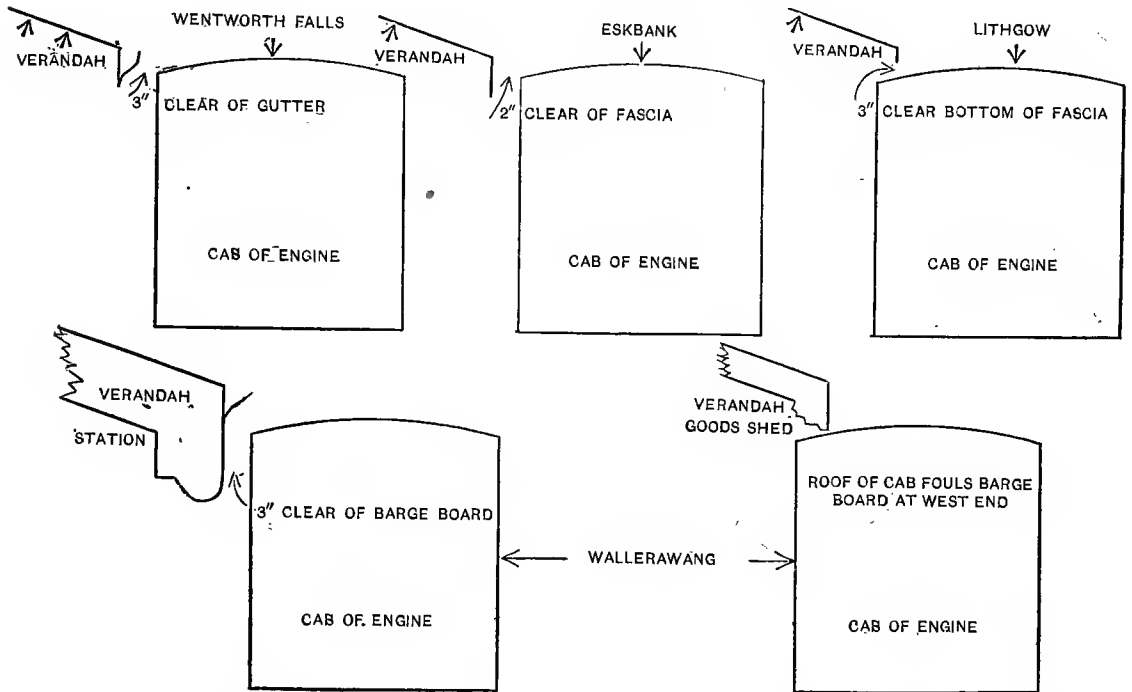
J. GREGORY,
31/7/91.
Eveleigh,

Mr. Stanger.

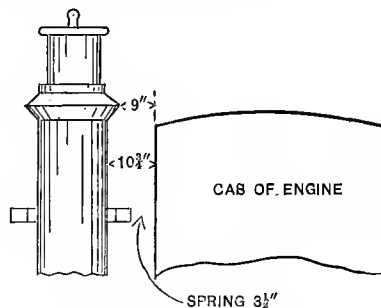
Eveleigh, 9 September, 1891.

No. 455 American engine working special between Emu Plains and Dubbo, to ascertain the clearance for cylinders and cab of engine between all platforms, verandahs, bridges and tunnels, &c.

On Saturday, September 5th, this engine left Redfern at 8.33 a.m. and arrived at Wallerawang 6.20 p.m. There is ample clearance for the cylinders and cab of engine between these two stations on platforms, &c., except Blaxland, Woodford, Lawson, Eskbank, Bowenfels, and the goods platform, Wallerawang. The following stations' verandahs only allow clearance thus:—



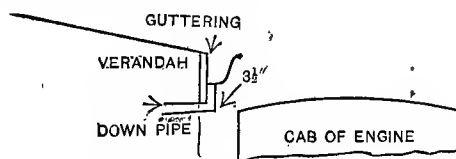
A spring which is attached to the water-column, west end of Lawson, to prevent the jib from swinging, clears the side of engine cab by $3\frac{1}{2}$ inches only.



The pilot will foul the coal-stage (made of old sleepers) when these engines are being turned on the table at Katoomba.

The roads leading into the Eskbank running-shed are not in the centre of the doorways, as the opening between doorposts is 9 feet 10 inches, very little clearance thus being allowed for side of cabs when entering this shed.

Sunday, 6th.—Rydal to Orange. There is ample clearance between cylinders and cab of engine between these two stations on platforms, &c., except Rydal, (up side) Bathurst, Wimbledon, Newbridge, Blayney (Cowra side), Spring Hill, and Bloomfield platforms. Cab of engine clears down-pipes from guttering on Orange verandah $3\frac{1}{2}$ inches only.

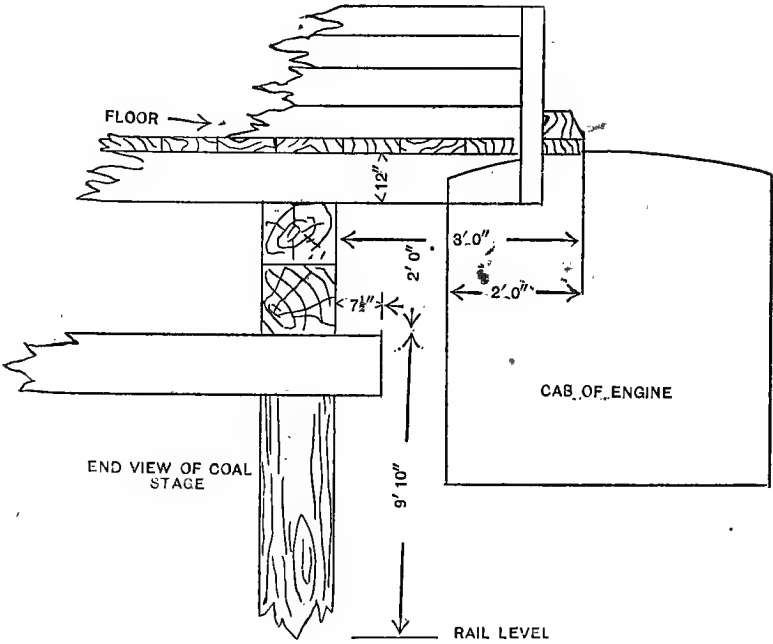


Guttering on Kelso verandah clears cab of engine 1 inch to 2 inches only.

A water-pipe projecting from the face of Tarana platform will require to be let in flush with face of same.

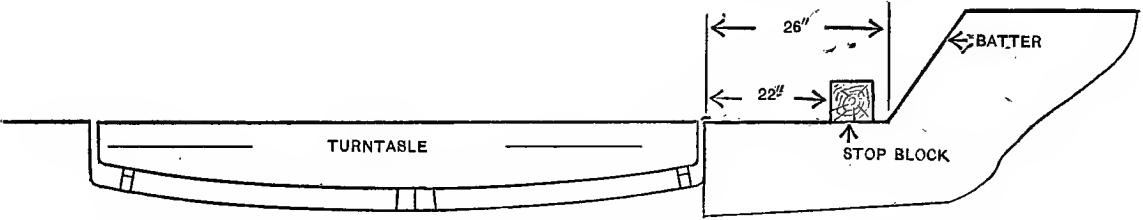
The

The coal-stage at Bathurst fouls cab of engine, thus :—



The sliding-doors on the sand-house, Orange, clear the handle on side of cab by 3 inches.

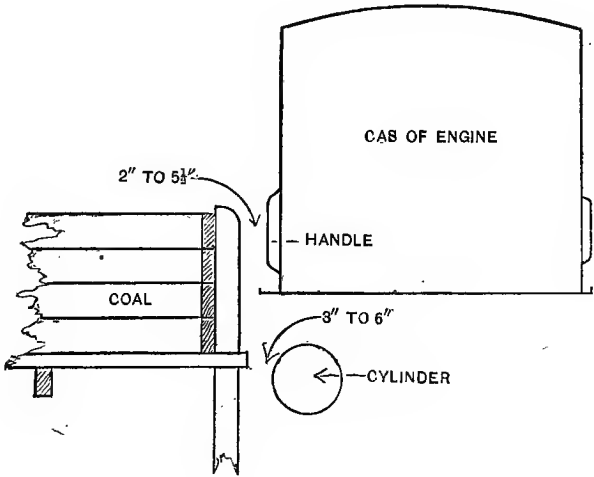
The stop-block at the end of road on the Orange turn-table will foul the pilot when turning these American engines. The batter will also require to be cut away to allow the pilot to pass. Thus :—



Monday, 7th.—Orange to Dubbo.—There is ample clearance for the cylinders and cab of engine between these two stations on platforms, &c., except Keer's Creek platform. On the face of the Wellington platform five water-pipes project. Also at Dubbo they will require to be let in flush with the face of platform.

Most of the end posts on the Wellington coal-stage (near running-shed) have been forced out at the top, caused by the stacking of coal, and foul the handle on the side of cab. These posts are not required, and could be cut off level with the floor of coal-stage. The ends of bolts will require to be cut off on posts at the sand-house coal-stage to give more clearance for cylinders.

The coal-stages at Mount Victoria, Wallerawang, Orange, and Dubbo are of similar construction to the Wellington one, and clear the cab from 2 inches to 5 1/2 inches; cylinders, 3 inches to 6 inches. Thus :—



Eveleigh, 14/8/91.

CLEARANCE of Cylinder on Engine 448 between platforms on the Southern Line, Merrylands to Albury.

Name of Platform.	Clearance of Cylinder.	Remarks.
Merrylands	4 in. to 5 in.	Cab fouls verandah down side.
Guildford	2 in. to 4½ in.	
Fairfield	2½ in. to 4 in.	Signal-box platform.
Canley Vale	3 in. to 4 in.	
Cabramatta	4 in. to 5 in.	Cylinder struck platform on up run.
Warwick Farm	9 in. down	
Liverpool	2½ in. to 5 in. down ; 1 in. to 3 in. up.	Down road is not being used.
Temporary Junction	9 in.	
Glenfield	4½ in. to 5 in.	Water-pipes project on platform.
Macquarie Fields	1 in. to 2½ in.	
Bumberry Junction	9 in.	Down road is not being used.
Ingleburn	2½ in. to 4½ in.	
Minto	2½ in. to 3½ in.	Water-pipes project on platform.
Leumeah Junction	Clear.	
Leumeah	1 in. to 3 in.	Down road is not being used.
Campbelltown	1 in. to 5 in.	
Glenlee	5 in.	Water-pipes project on platform.
North Menangle	7½ in. to 8 in.	
Menangle	2 in. to 4 in. down ; ½ in. to 4 in. up.	Cylinder struck platform on up run.
Douglas Park	2 in. to 4½ in. old plat- form ; new platform, 3½ in. to 5 in.	
Ballast Siding	3½ in. to 4 in.	Platform of sleepers to be moved back.
Maldon	3½ in. to 4 in.	Cylinder fouled platform on down run.
Picton	3½ in. to 5½ in.	
Thirlmere	4½ in.	Guttering on verandah to be moved.
Picton Lakes	4½ in. to 5½ in.	
Balmoral	4½ in. to 5 in.	Guttering on verandah to be moved.
Hill Top	4½ in. to 5 in.	
Colo Vale	3½ in. to 4½ in.	Guttering on verandah to be moved.
Rush's	5 in.	
Mittagong	4 in. to 6 in.	Or Karalla.
Bowral	3 in. to 4½ in.	
Burradoo	3½ in. to 4 in.	Or Karalla.
Bong Bong	6 in.	
Moss Vale	3½ in. to 5 in.	Or Karalla.
Meryla	4 in. to 5 in.	
Exeter	4½ in. to 5 in.	Or Karalla.
Bundanoon	5 in.	
Wallondilly	5 in.	Or Karalla.
Cable's Siding	4½ in.	
Wingello	3 in. to 5½ in.	Or Karalla.
Barber's Creek	5 in. to 7 in.	
Marulan	1½ in. to 3 in.	Or Karalla.
Carrick	5 in. to 5½ in.	
Towrang	4½ in. to 5 in.	Or Karalla.
Murray's Flats	3 in.	
North Goulburn	2 in. to 4 in.	Or Karalla.
Goulburn	3 in. to 4 in.	
Yarra	2½ in. to 3½ in.	Or Karalla.
Breadalbane	5 in.	
Cullerin	5 in.	Or Karalla.
Razorback	4 in. to 5 in.	
Fish River	5½ in. to 6 in.	Or Karalla.
Gunning	4½ in. to 5 in.	
Oolong	4½ in. to 5 in.	Or Karalla.
Jerrawa	2½ in. to 4 in.	
Coolalie	1½ in. to 2 in.	Or Karalla.
Yass	2½ in. to 3½ in.	
Bowning	2½ in. to 3 in.	Or Karalla.
Goondah	3½ in. to 4 in.	
Binalong	2½ in. to 4 in.	Or Karalla.
Galong	2 in.	
Rocky Ponds	2 in. to 3 in.	Or Karalla.
Cunningar	3½ in. to 4 in.	
Harden	3½ in. to 4 in.	Or Karalla.
Murrumburrah	½ in. to 6 in.	
Demondrille Junction	3½ in. to 6 in.	Or Karalla.
Nubba	3 in.	
Wallendbeen	1½ in. to 3 in.	Or Karalla.
Cootamundra	1½ in. to 3 in.	
Mullaly's Siding	3 in. to 3½ in.	Or Karalla.
Frampton	3 in. to 3½ in.	
Ballast Siding	2½ in. to 3 in.	Or Karalla.
Bethunga	3½ in. to 4 in.	
Illabo	Down, 4½ in. to 6½ in. ; up, 3 in. to 4½ in.	Or Karalla.
June	5 in.	
Harefield	2½ in. to 3½ in.	Or Karalla.
Bomen	2½ in. to 3 in.	
Wagga	3 in. to 4 in.	Or Karalla.
Uranquinty	3 in. to 4 in.	
Bon Accord Siding	3 in.	Or Karalla.
The Rock	3 in. to 4 in.	
Yerong Creek	3 in. to 4 in.	Or Karalla.
Henty	2½ in. to 5 in.	
Culeairn	2½ in. to 3 in.	Or Karalla.
Gerogery	2½ in. to 3 in.	

Name of Platform.	Clearance of Cylinder.	Remarks.
Yambla	1 in. to 2 in.	
Ettamogah	4 in. to 4½ in.	
Albury Racecourse	2½ in.	
Albury	2½ in. to 4 in.	
Emu Plains	5 in. to 5½ in.	
Lucasville	6½ in.	
Glenbrook	5 in. to 5½ in.	
Blaxland	2 in. to 3½ in.	
Karabar	4½ in. to 5½ in.	
Valley Heights	4 in. to 5 in.	
Springwood	5 in. to 7½ in.	
Faulconbridge	5½ in. to 8½ in.	
Numantia	6 in. to 7 in.	
Linden	5 in. to 6½ in.	
Woodford	2½ in. to 5½ in.	
Hazelbrook	5½ in. to 8 in.	
Lawson	3½ in. to 4½ in.	Cab clears water-column 3½ in. only.
Wentworth Falls	5½ in.	Verandah guttering to be removed.
Leura	4 in. to 4½ in.	
Katoomba	Down 5½ in. to 6½ in. ; up, 4 in. to 7 in.	
North's Siding		No platform.
Medlow	5½ in. to 6 in.	
Blackheath	5½ in. to 5½ in.	
Mount Victoria	Down, 4½ in. to 5½ in. ; up, 5½ in. to 6 in.	
Hartley Vale	5½ in. to 7 in.	
Bell	6 in. to 6½ in.	Clears goods-shed and platform.
Clarence Siding	Down, 5½ in. to 6 in. ; up, 4 in. to 4½ in.	
Zigzag	Down, 5½ in. to 6 in. ; up, 5 in. to 5½ in.	
Esk Bank C. Stage		Clears the stage and coal-shoot.
Esk Bank	Down, 4 in. to 5 in. ; up, 3½ in. to 6 in.	Cab clears verandah 2 in.
Lithgow	Down, 5½ in. to 6 in. ; up, 4 in. to 4½ in.	Cab clears verandah 3 in.
Bowenfels	Down, 4½ in. to 5½ in. ; up, 3½ in. to 4 in.	
Marrangaroo	6 in. to 7 in.	
Wallerawang	5½ in. to 6 in.	Mudgee side 4 in. to 5 in.
„ Goods Platform	3½ in. to 4 in.	Cab clears barge-board on station verandah 3 in., and fouls same on goods-shed.
Rydal	Down, 4 in. ; up, 3 in. to 4 in.	
Sodwalls	8 in. to 9 in.	
Tarana	4 in. to 5 in.	Water-pipe projects from face of platform.
Locksley	4 in. to 5 in.	
Brewongle	4 in. to 4½ in.	
Raglan (new)	Down, 4 in. to 7½ in. ; up, 5½ in. to 7½ in.	
„ (old)	4 in. to 4½ in.	
Kelso	4 in. to 5 in.	Guttering on verandah to be moved.
Bathurst	Down, 2 in. to 3 in. ; up, 3½ in. to 4½ in.	Cab fouls coal-stage.
Orton Park	4 in. to 4½ in.	
Perth	4 in. to 5½ in.	
George's Plains	5 in. to 6½ in.	
Wimbledon	3 in. to 5½ in.	
Newbridge	3½ in. to 4½ in.	
Blayney	4½ in. to 5 in.	
„ (Cowra side)	3½ in. to 5½ in.	
Millthorpe	New platform, 4 in. to 5 in. ; old, 4 in. to 6½ in.	Fouls goods-stage.
Spring Hill	3½ in. to 4½ in.	
Huntley	4½ in. to 5½ in.	
Bloomfield	3½ in. to 4 in.	
Orange	5½ in. to 6 in.	Cab clears down-pipe on verandah 3½ in.
„ (Molong side)	5½ in. to 7 in.	Stop-block fouls the pilot on turn-table.
Mullion	4½ in. to 5 in.	
Keer's Creek	3½ in. to 4½ in.	
Warne	4½ in. to 5 in.	
Store Creek	4 in. to 5 in.	
Stuart Town	5 in. to 6 in.	
Mumbil	4½ in. to 5½ in.	
Dripstone	4½ in. to 6 in.	
Apsley	4½ in.	
Wellington	4½ in. to 5 in.	Water-pipes project from face of platform.
Mary Vale	4½ in. to 5½ in.	
Geurie	4 in. to 4½ in.	
Murrumbidgee	5 in. to 5½ in.	
Dubbo	4 in. to 5½ in.	

There is ample clearance for the cabs of these new American engines going through and under all tunnels and bridges on the Western line between Emu Plains and Dubbo, except a brick bridge over the road at mileage 126.78. The road under this bridge is on 16 chain roads; this road is to be lowered, and will then give sufficient clearance.

The doors of running-sheds on this line, Emu Plains to Dubbo, all allow ample clearance for the cab of engine, with the exception of Esk Bank depot. Engine No. 455 returned from Dubbo on 9/9/91.

H. ROBINSON.

E. A. Laughry, Esq.

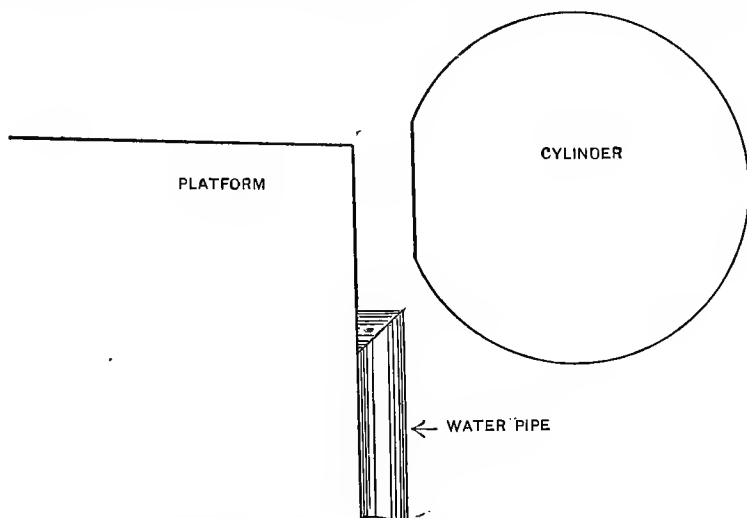
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There is ample clearance for the cabs of these new American Engines going through and under all tunnels and bridges on the Southern Line from Merrylands to Albury. The doors of running-sheds on this line will allow the cabs ample clearance to enter the shed.

Engine 448 was placed on the running-shed traverser at Goulburn; the table of traverser is long enough to hold the engine; however, on account of the pilot projecting, the bottom of it fouled the hydrants on the water-main, which is used for washing out, &c., &c., consequently the engine could not be stabled in this shed.

It will be observed from the above measurements that the clearance for the cylinder between platforms from Merrylands to Albury, in the majority of platforms, is considerably under four inches. Fairfield was the only station-verandah which fouls the cab; the insulators supporting the telegraph wires which are fixed into the fascia of the Fairfield verandah will have to be removed.

At Campbelltown, Goulburn, and Wagga, two or three water-pipes project from the side of each platform; it will be advisable to have each of the pipes let in flush at the top with the face of the brickwork.



The gutterings on verandahs at Colo Vale and Culcairn are to be moved back to give more clearance for the cab.

The outside coal-stage platform at Goulburn clears the cylinder by $\frac{1}{8}$ inch only.

Engine 448 left Redfern 9.5 a.m., Sunday, 9th August, for Albury, and returned 6.35 p.m., Thursday, August 13th.

H. E. ROBINSON.

E. A. Laughry, Esq., Chief Mechanical Engineer.

Eveleigh, 31 July, 1891.

No. 448—New American Express Engine, working train, No. 57, down, 30th July; working train No. 28, up, 30th July, between Sydney and Oatley.—I joined engine 448 at Hurstville on the down run. Driver R. Baker speaks highly of her working between Sydney and Hurstville. However, the reversing-gear works a little stiff, and will require adjusting in the spring-balance. The clearance for the cylinders on the down and up platforms at Penshurst and Oatley is from 3 inches to $3\frac{1}{2}$ inches.

On the up trip, engine 448 left Hurstville with a train of 36 wagons and a six-wheeled brake-van, made up as follows: 29 loaded with mineral, 6 general goods, 1 empty. Two wagons containing mineral were shunted off at Rockdale, and the rest of the train brought on to Eveleigh. From Tempe to Eveleigh the rails were wet owing to rain, and sand was used occasionally. The boiler-pressure ranged from 120lbs. to 135lbs. between Marrickville and Eveleigh.

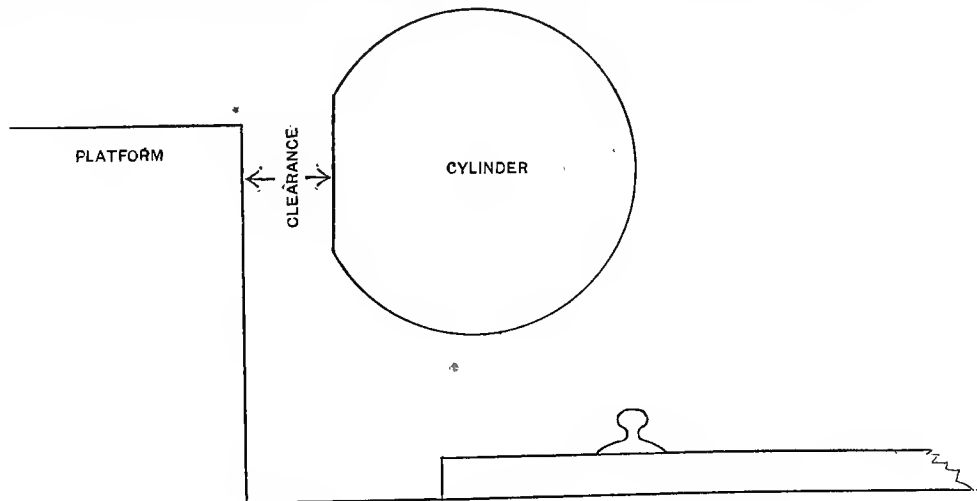
H. E. ROBINSON.

E. A. Laughry, Esq.

Eveleigh, 8 August, 1891.

No. 448—New American Express Engine, working special between Strathfield and Jennings, to ascertain the clearance between cylinders and cab of engine and all platforms, verandahs, bridges and tunnels, etc.

This engine ran to Gosford and returned to Redfern on Friday, July 31st, with the District-Engineer. The clearance between outside of cylinder and platforms varied from 4 inches to 6 inches.

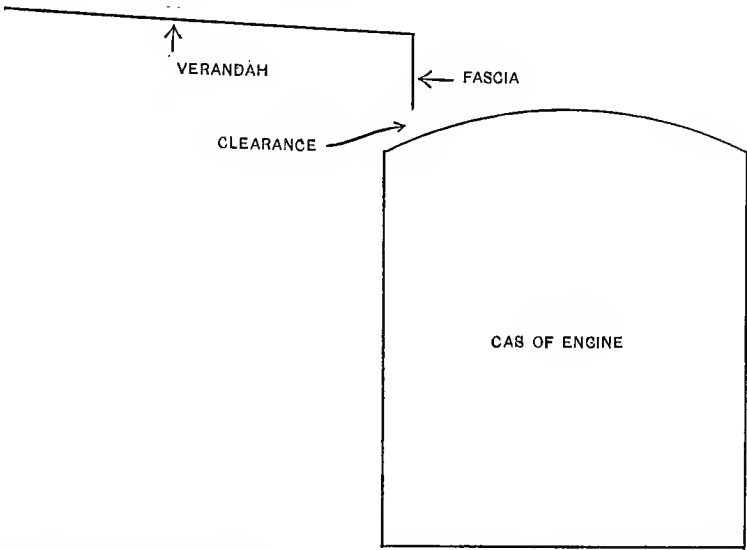


The cab clears all verandahs, bridges and tunnels between Strathfield and Gosford, leaving ample room or clearance when the engine oscillates; when running at a high speed, or through a soft place or curve in the road.

The valve-box connected with the water main which is carried over the Parramatta River Bridge on the up road clears the cylinder by $2\frac{1}{2}$ inches. This clearance is sufficient; however, it would be preferable to have this valve-box moved further from the cylinder.

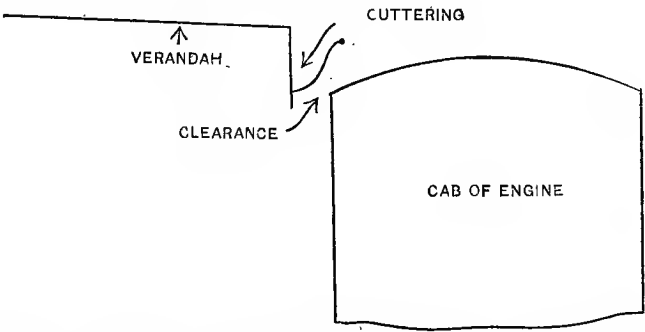
On Saturday, August 1st, engine 448 left Redfern for Jennings, with the District-Engineer (for Northern lines). The clearance between cylinder and platforms from Gosford to Honeysuckle Point varied from 4 inches to 6 inches.

Newcastle platform varied from 3 inches to 5 inches. All verandahs, bridges and tunnels allow the cab ample clearance, with the exception of the verandah at Cockle Creek, which only allows $\frac{7}{8}$ inch clearance between the fascia and roof of the engine-cab.

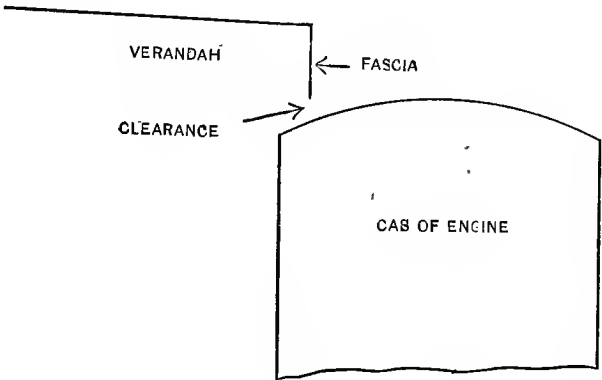


After leaving Gosford, one of the tender-axe box-brasses ran hot, and, on arrival in Newcastle, the brass was removed from the hot box, refitted, and the remaining boxes examined. This necessitated the engine remaining the night here.

Sunday, 2nd August. Newcastle to Murrurundi.—The clearance between cylinder and platforms from Newcastle to Murrurundi varied from 4 inches to 6 inches, with the exception of East Maitland. The clearance at this station varied from 3 inches to 5 inches on the up platform. The platforms at Lochinvar, Allandale, Branxton, Belford, Rix's Creek, Nundah signal-box, and Toowong varied from $3\frac{1}{2}$ inches to 5 inches. All verandahs, bridges, etc., allow ample clearance for the cab, with the exception of East Maitland, the guttering of which completely fouls the side of cab on the down side. The guttering and fascia on the Muswellbrook verandah clears only by $1\frac{1}{4}$ inch.

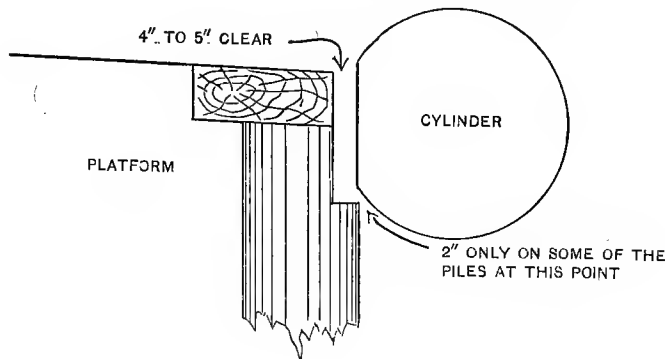


On the up platform at High-street (Maitland) the bottom of verandah only clears the roof of cab by half-an-inch.

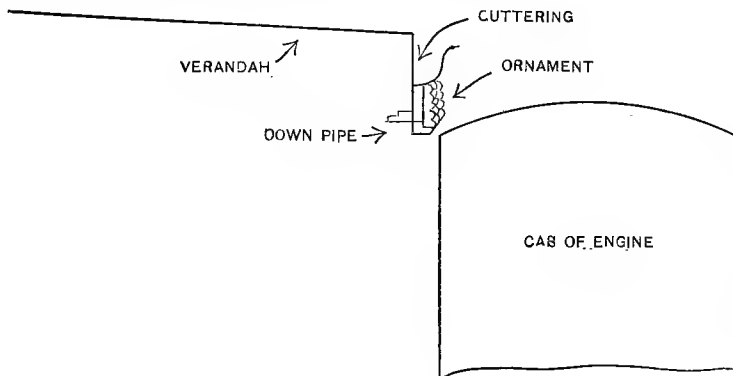


When about 20 miles from Newcastle the same tender axle-box ran hot, notwithstanding that every precaution was taken. It heated to such an extent that the tender had to be lifted at Singleton. The journal was slightly cut and the brass very much scored. The journal was filed up, brass refitted, and white metal let into same. This caused a delay of six hours. On examination I found that the lubricators were not up on three of the journals. On the run from Scone to Murrurundi four tender axle-boxes ran a little hot; at the latter station the engine was stabled for the night, one axle brass tender axle-box. After these oil-cups were fixed the boxes gave no trouble for the remainder of the journey. It will not be desirable to continue the use of these oil-cups, on account of the quantity of oil they waste; if the boxes are properly packed it will relieve this difficulty.

Monday, 3rd August. Murrurundi to Armidale.—The clearance between cylinder and platforms from Murrurundi to Armidale varied from 4 inches to 5 inches, with the exception of Doughboy Hollow platform, which varied from $2\frac{1}{2}$ inches to 3 inches. (This platform is to be replaced by a new one). The platform at Willow Tree clears the cylinder from 4 inches to 5 inches on the top, but some of the timber piles have not been sufficiently cut away and may be apt to foul the cylinder.

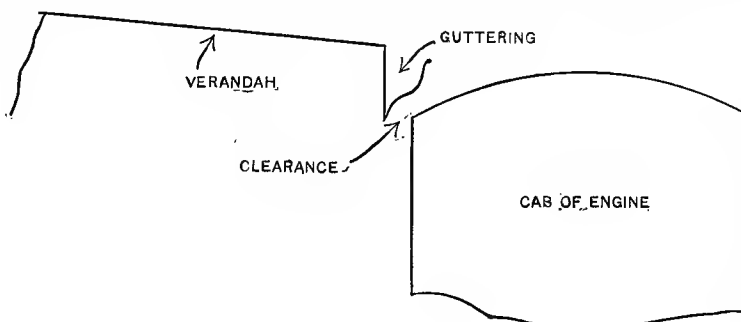


All the verandahs, bridges, and tunnels, &c., allow ample clearance for the cab, with the exception of Werri Creek verandah; the moulding on the side of cab just touches the down-pipes and ornaments covering same leading from the guttering.



The guttering on verandah at Walcha Road platform hardly allows sufficient clearance for the cab on the up end. When approaching Armidale, the engine (448) ran through and smashed Peckes' gates. The driver did not give the gatekeeper sufficient warning, as no notice of this special was given, and the whistle was not blown until within 200 yards of the gates. The pilot (cow-catcher) lifted the gates off the rails, and threw pieces of the gates into the air to the left and right. No damage was done to the engine beyond breaking one head-lamp and a slight strain to the pilot. During the run to Armidale, the boiler primed badly. The engine being stabled here for the night, the boiler was washed out, and the water changed; for the remaining portion of the journey the boiler steamed splendidly.

Tuesday, 4th August. Armidale to Jennings and return.—The clearance between cylinder and platforms from Armidale to Jennings varied from 4 inches to 5 inches, with the exception of the new timber-faced platform at Glencoe, which varied from 3 inches to 4 inches. Glen Innes platform varied from $3\frac{1}{2}$ inches to 4 inches. All verandahs, bridges, &c., allow ample clearance for the cab, with the exception of the verandah guttering at Dundee, which gives the cab $2\frac{1}{2}$ inches clearance.



On the return run from Jennings to Armidale the R.H. leading axle-box on engine bogie ran hot. The keep of same was taken down at Armidale, journal examined and found to be in good condition. Keep repacked, this box ran fairly cool for the remainder of the journey.

Wednesday, 5th August. Armidale to Newcastle.—After passing Greta the L.H. pin in the quadrant link-block broke. On examination I found that this pin had previously seized in the block, and had been working so for five or six days; this pin then worked loose in the rocking-shaft, and, for the want of lubrication, seized in same; the pin thus being held fast in the shaft and link-block was sheared and broken off. The broken pin was sent to you for inspection. Engine 426, working, 101, down, pushed the disabled engine to Greta, where she was picked up by engine 419 (which was wired for at Singleton) and towed into Newcastle. The pin was replaced at Newcastle, and the engine reached Eveleigh on Friday, 7th, at 1:30 p.m.

H. E. ROBINSON.

E. A. Laughry, Esq.

Name of Platform.	Clearance of Cylinder.	Remarks.
Strathfield	4 in. to 5½ in.	The following platforms, from Strathfield to Jennings, were measured as the engine passed slowly by each one.
Concord	6 in.	
Rhodes	5 in. to 6½ in.	
Meadow Bank	4 in. to 4½ in.	
Ryde	4 in. to 6 in.	
Eastwood	4 in. to 5 in.	
Carlingford	5½ in. to 6 in.	
Beecroft	3 in. to 3½ in.	
Pennant Hills	4½ in.	
Thornleigh	5½ in. to 6½ in.	
Hornsby	5½ in.	Did not go over North Shore line.
Colah	4½ in. to 5 in.	
Berowra	5½ in. to 6 in.	
Cowan	5½ in.	
Hawkesbury River	3½ in. to 5½ in.	
Wondabyne	Clears	
Mullet Creek	4½ in. to 8 in.	
Woy Woy	4½ in. to 4½ in.	
Point Clare	3½ in. to 4½ in.	
Gosford	5 in.	
Narara	4½ in. to 5 in.	
Ourimbah	3½ in. to 5 in.	
Tuggerah	3½ in. to 5 in.	
Wyong	5 in. to 7 in.	
Wyee	4 in. to 6 in.	
Morisset	3 in. to 4½ in.	
Dora Creek	4 in. to 5 in.	
Awaba	4 in. to 5 in.	
Fassifern	4 in. to 5 in.	Did not take engine into siding.
Teralba	4 in. to 6 in.	
Cockle Creek	4 in. to 6 in.	Cab almost touches verandah.
Young Wallsend	4½ in.	
Cardiff	4 in. to 5½ in.	
Adamstown	4 in. to 5½ in.	
Broadmeadow	4 in. to 5 in.	
Islington	4 in. to 5½ in.	To Newcastle.
Hamilton	4 in. to 5 in.	
Honeysuckle	5 in. to 6 in.	
Newcastle	3 in. to 5 in.	
Waratah	4 in. to 5 in.	Verandah not complete.
Sandgate	4 in. to 5 in.	
Hexham	4 in. to 5 in.	
Tarro	4 in.	
Thornton	4 in.	
Victoria-street	3 in. to 4 in.	
East Maitland	3½ in. to 5 in.	Fouls verandah.
High-street	3½ in. to 5 in.	
West Maitland	3 in. to 4 in.	Verandah too close up platform.
Farley	4 in. to 5 in.	
Lochinvar	3½ in. to 5 in.	New verandah clears cab 8½ in.
Allandale	3½ in. to 4 in.	
Anvil Creek		No record taken.
Greta	4 in. to 5 in.	
Branxton	3½ in. to 4 in.	
Belford	3½ in. to 4 in.	
Whittingham	4 in. to 4½ in.	
Singleton	4 in.	
Rix's Creek	3½ in. to 4 in.	
Nundah	3½ in.	
Glennie's Creek	4 in. to 4½ in.	
Ravensworth	4 in. to 5 in.	
Liddell	4 in.	
Toowong	3 in.	
Grass Tree	4 in.	
Muswellbrook	4 in. to 5 in.	Verandah too close.
Aberdeen	4½ in. to 5 in.	
Scone	4 in. to 5 in.	
Parkville	4 in.	
Wingen	4 in.	
Blandford	5 in. to 5½ in.	
Murrurundi	4½ in. to 5 in.	Verandah not complete.
Temple Court	4 in.	
Doughboy Hollow	2½ in. to 3 in.	Platform to be rebuilt. Timber piles to be cut down.
Willow Tree	4 in. to 5 in.	
Bracefield	4 in. to 5 in.	

Name of Platform.	Clearance of Cylinder.	Remarks
Quirindi	4 in. to 5 in.	Fonls verandah, &c. Did not go over the N.W. line.
Quipolly	5 in. to 5½ in.	
Werris Creek	5 in. to 6 in.	
Terrible Vale	4 in. to 5 in.	
Currabubula	4 in. to 5 in.	Guttering projects.
Duri	4 in. to 5 in.	
West Tamworth	5 in. to 6 in.	
Tamworth	5 in. to 5½ in.	
Tintinhull	4½ in.	
Moonbi	4 in. to 5 in.	
Farquharson	4 in.	
Macdonald River	4 in.	
Walcha Road	4 in. to 5 in.	
Wollun	4 in.	
Kentucky	4 in. to 5 in.	New platform 3 in. to in.
Uralla	4 in. to 5 in.	
Kelly's Plains	4 in. to 5 in.	
Armidale	4 in. to 5 in.	
Dumaresq	4 in. to 5 in.	
Duval	4 in.	
Black Mountain	4 in. to 5 in.	
Gnyra	5 in. to 6 in.	
Llangothlin	5 in. to 6 in.	
Ben Lomond	5 in. to 5 in.	
Glencoe	4 in. to 5 in.	Guttering on verandah too close.
Stonehenge	4 in. to 5 in.	
Glen Innes	3½ in. to 4 in.	
Yarraford	4 in. to 5 in.	
Dundee	5 in. to 6 in.	
Deepwater	5 in. to 6 in.	
Bolivia	4 in. to 5 in.	
Sandy Flat	5 in. to 6 in.	
Bluff Rock	6 in. to 7 in.	
Tenterfield	4 in. to 5 in.	
Sunnyside	5 in. to 5½ in.	
Jennings	4 in. to 5 in.	

There is ample clearance for the cab of these new American engines going through and under all the tunnels and bridges on the Northern line. The tunnels varied in clearance from 7½ in. to 16 in.

All doors of running sheds on the Northern line will allow cabs of new American express engines to enter the sheds.

At mileage 364·10 the engine struck something on the line and threw ballast about. Being on a ticket we did not go back to see what it was. The train was pulled up. On examining the engine and car no marks could be found.

The District Engineer sent a ganger back from the next station to inspect about mileage 364·10. I have not been informed of the result.

Standard Profile Measurements to Existing Structures—Passenger Platforms.

P.S.—All measurements from inside of rail, except books 6, 7, and 8, which are from centre of rail.

Name of Station.	Description of Platform.	Measurements.			Cant.		No. and page in Field Book.	Remarks.
		Top.	Bottom.	Height from rail.	In.	Out.		
GREAT SOUTHERN RAILWAY—GRANVILLE TO ALBURY.								
Granville (up line)	Brick (stone cap.)	ft. 2 6½	in. 2 1½	ft. 3 1½	in. ...	in. ...	Page.No. 71 2	Dished 1½ in.
"	"	2 6	2 2½	3 0	...	...	71 2	Dished 1½ in.
" (down line)	"	2 5½	2 2½	2 10½	...	...	70 2	Dished 1½ in.
"	"	2 6¼	2 3½	2 10½	...	...	70 2	Dished 1½ in.
"	"	2 9½	2 5½	2 10	...	...	65 2	
Merrylands	Timber	2 9½	2 5½	2 10	...	...	65 2	6 in. x 6 in. piles.
Guildford	"	2 6½	2 11	2 11½	...	...	65 2	
Fairfield	Brick (stone cap.)	2 5½	2 2½	2 7½	1½	...	63 2	
Canley Vale	Timber	2 6½	3 0	2 8½	...	...	62 2	6 in. x 6 in. piles.
Cabramatta	"	2 5	2 9¼	2 10½	...	...	60 2	6 in. x 6 in. piles.
Warwick Park	Brick	2 8½	2 5½	2 9½	...	...	59 2	
Liverpool	Brick (stone cap.)	2 6½	2 3	2 9½	...	...	58 2	Dished 1½ in.
Glenfield	Brick	2 8¼	2 5½	2 8½	...	...	51 2	
Macquarie Fields	"	2 7	2 3	2 10½	...	...	50 2	
Ingleburn	"	2 7¾	2 3½	2 10½	...	...	49 2	Dished 1½ in.
"	"	2 7½	2 3	2 10½	...	...	49 2	
Minto	Timber	2 6½	2 11½	2 10½	...	...	49 2	6 in. x 6 in. piles
Leumeah	Brick	2 7½	2 4½	2 8½	...	...	47 2	
Campbelltown	Brick (stone cap.)	2 5	2 2	2 9½	...	...	43 2	Dished 1½ in.
"	Brick	2 7½	2 4	2 9½	...	...	43 2	

Name of Station.	Description of Platform.	Measurements.			Cant.		No. and page in Field Book.	Remarks.
		Top.	Bottom.	Height from rail.	In.	Out.		

GREAT SOUTHERN RAILWAY—GRANVILLE TO ALBURY—continued.

Between North Menangle and Campbelltown.	Timber	2 8	2 10 $\frac{3}{4}$	2 7 $\frac{1}{8}$	1 $\frac{1}{2}$	...	38 2	8 in. diameter piles.
North Menangle	"	3 0 $\frac{1}{2}$	3 2	2 19 $\frac{3}{4}$	...	...	38 2	6 in. x 6 in. piles.
Menangle	Brick (stone cap.)	2 6	2 2 $\frac{1}{2}$	2 10 $\frac{1}{4}$	2	...	35 2	
"	Timber	2 6 $\frac{1}{2}$	2 11 $\frac{1}{2}$	2 11 $\frac{1}{2}$	...	1 $\frac{1}{2}$	35 2	7 in. x 9 in. piles.
Douglas Park	"	2 6 $\frac{1}{2}$	2 11 $\frac{1}{2}$	3 0 $\frac{1}{2}$	1 $\frac{1}{2}$	...	32 2	6 in. x 6 in. piles.
Maldon	"	2 7 $\frac{1}{2}$	2 7 $\frac{1}{2}$	2 9	...	3 $\frac{3}{8}$	31 2	6 in. x 6 in. piles.
P.eton	Brick (stone cap.)	2 5 $\frac{1}{2}$	2 1 $\frac{1}{2}$	2 10 $\frac{1}{2}$	...	...	28 2	Dished 1 $\frac{1}{2}$ in.
Thirlmere	Masonry	2 8 $\frac{1}{2}$	2 5 $\frac{1}{2}$	2 7 $\frac{1}{2}$	...	1	25 2	Ashlar cap set off 1 $\frac{1}{2}$ in.
P.eton Lakes	Old sleepers	2 8 $\frac{1}{2}$	2 10	2 9 $\frac{1}{2}$	...	3	25 2	
Balmoral	Timber	2 7 $\frac{1}{2}$	3 0 $\frac{1}{2}$	2 9 $\frac{1}{2}$	...	...	24 2	6 in. x 6 in. piles.
Hill Top	Masonry	2 8 $\frac{1}{2}$	2 5 $\frac{1}{2}$	2 9 $\frac{1}{2}$	...	...	24 2	Ashlar cap set off 1 $\frac{1}{2}$ in.
Colo Vale	"	2 8 $\frac{1}{2}$	2 4 $\frac{1}{2}$	2 9 $\frac{1}{2}$	2	...	23 2	Ashlar cap set off 1 $\frac{1}{2}$ in.
Rush's	Timber	2 6 $\frac{1}{2}$	2 8 $\frac{1}{2}$	2 9 $\frac{1}{2}$	...	...	23 2	9 in. x 5 in. piles.
Mittagong	Brick (stone cap.)	2 7	2 4 $\frac{1}{2}$	2 10 $\frac{1}{2}$	1 $\frac{1}{2}$	...	21 2	
Bowral	"	2 4 $\frac{1}{2}$	2 1 $\frac{1}{2}$	2 11	...	...	13 2	
Burradoo	Timber	2 5 $\frac{1}{2}$	2 10 $\frac{1}{2}$	2 9	...	...	13 2	6 in. x 6 in. piles.
Bong Bong	"	2 6	2 11 $\frac{1}{2}$	2 10 $\frac{1}{2}$	...	...	10 2	6 in. x 6 in. piles.
Moss Vale	Brick (stone cap.)	2 3 $\frac{3}{8}$	2 0 $\frac{1}{2}$	2 7 $\frac{1}{2}$	...	...	6 2	Set off 1 $\frac{1}{2}$ in.
Meryla	Masonry	2 8 $\frac{1}{2}$	2 5 $\frac{1}{2}$	2 7 $\frac{1}{2}$	...	...	5 2	Set off 1 $\frac{1}{2}$ in.
Exeter	Brick (stone cap.)	2 7 $\frac{1}{2}$	2 5 $\frac{1}{2}$	2 9 $\frac{1}{2}$	2 $\frac{1}{8}$	...	4 2	Set off 1 $\frac{1}{2}$ in.
Bundanoon	Timber	2 0 $\frac{1}{2}$	2 13	2 8 $\frac{1}{2}$	...	...	2 2	6 in. x 6 in. piles.
Wollondilly	Old sleepers	2 8	2 8	2 7 $\frac{1}{2}$	2 $\frac{1}{4}$	...	2 2	
Wingello	Masonry	2 6 $\frac{1}{2}$	2 4	2 9 $\frac{1}{2}$	...	...	1 2	Set off 1 $\frac{1}{2}$ in.
Barber's Creek	Timber	2 9 $\frac{1}{2}$	3 2 $\frac{1}{2}$	2 9 $\frac{1}{2}$	...	...	165 1	6 in. x 6 in. piles.
Marulan	Brick (stone cap.)	2 6	2 3 $\frac{1}{2}$	2 9 $\frac{1}{2}$	1 $\frac{1}{4}$	...	161 1	
Carriick	Timber	2 5	2 10 $\frac{1}{2}$	2 8	...	...	157 1	6 in. x 6 in. piles.
Towrang	"	2 5 $\frac{1}{2}$	2 13 $\frac{1}{2}$	2 7 $\frac{1}{2}$	...	...	157 1	6 in. x 6 in. piles.
Murray's Flats	Masonry (brick cap.)	2 6 $\frac{1}{2}$	2 5 $\frac{1}{2}$	2 8 $\frac{1}{2}$	...	...	153 1	Set off 1 $\frac{1}{4}$ in.
North Goulburn	Brickwork	2 7 $\frac{1}{2}$	2 2 $\frac{1}{2}$	2 9 $\frac{1}{2}$	...	...	153 1	
Goulburn	Brick (stone cap.)	2 7 $\frac{1}{2}$	2 2 $\frac{1}{2}$	2 11 $\frac{1}{2}$	...	...	141 1	Dished 1 in.
"	"	2 9	2 2 $\frac{1}{2}$	2 10 $\frac{1}{2}$	...	...	144 1	Dished 1 $\frac{1}{4}$ in.
Yarra	Brick	2 5 $\frac{1}{2}$	2 3 $\frac{1}{2}$	2 5 $\frac{3}{8}$	...	...	98 1	
Breadalbane	"	2 4 $\frac{1}{2}$	2 2 $\frac{1}{2}$	2 2 $\frac{1}{2}$	...	1 $\frac{1}{2}$	89 1	
Razorback	Old sleepers	2 8	2 7 $\frac{1}{2}$	2 10 $\frac{1}{2}$	4 $\frac{1}{8}$	...	89 1	
Fish River	Brick	2 4 $\frac{1}{2}$	2 2	2 6 $\frac{1}{2}$	...	1 $\frac{1}{2}$	87 1	
Gunning	"	2 4 $\frac{1}{2}$	2 1 $\frac{1}{2}$	2 11	...	...	87 1	
Gunning, Jerrawa	Old sleepers	2 5 $\frac{1}{2}$	2 6	2 8 $\frac{1}{2}$	...	...	83 1	
Jerrawa	Brick	2 5 $\frac{1}{2}$	2 3 $\frac{1}{2}$	3 0 $\frac{1}{4}$	...	...	82 1	
Jerrawa, Yass	Old sleepers	2 6 $\frac{1}{2}$	2 8	2 7 $\frac{1}{2}$	...	...	83 1	
Yass	Masonry (brick cap.)	2 6 $\frac{1}{2}$	2 4 $\frac{1}{2}$	2 7	...	...	79 1	
Bowning	Brick	2 6 $\frac{1}{2}$	2 3 $\frac{1}{2}$	3 0 $\frac{1}{4}$	...	...	74 1	
Binalong	Masonry	2 5 $\frac{1}{2}$	2 1 $\frac{1}{2}$	2 8 $\frac{1}{2}$	...	1 $\frac{1}{8}$	67 1	
Galong	Brick	2 5 $\frac{1}{2}$	2 2 $\frac{1}{2}$	2 9 $\frac{1}{2}$	...	...	65 1	
Rocky Ponds	"	2 6 $\frac{1}{2}$	2 3 $\frac{7}{8}$	2 4 $\frac{3}{8}$	3 $\frac{1}{4}$	...	64 1	Dished 1 $\frac{1}{4}$ in.
Cunningar	"	2 4 $\frac{1}{2}$	2 1 $\frac{1}{2}$	2 8 $\frac{3}{8}$	...	...	62 1	
Harden	Masonry (brick cap.)	2 7 $\frac{1}{2}$	2 1 $\frac{1}{2}$	2 10 $\frac{1}{2}$	...	...	57 1	
Murrumburrah	Timber	2 3 $\frac{1}{2}$	2 9	2 7 $\frac{1}{2}$	2 $\frac{1}{2}$	...	4 1	6 in. x 6 in.
Demondrille	Masonry (brick cap.)	2 7 $\frac{1}{2}$	2 5	2 10 $\frac{1}{2}$	...	2 $\frac{1}{2}$	1 1	Set off 1 $\frac{1}{4}$ in.
Nubba	Brick	2 6 $\frac{1}{2}$	2 0 $\frac{1}{2}$	2 9 $\frac{1}{2}$	...	...	45 1	
Wallendbeen	"	2 5 $\frac{1}{2}$	2 3 $\frac{3}{8}$	2 8 $\frac{3}{8}$	...	...	49 1	
Cootamundra	Masonry (wood cap.)	2 4 $\frac{1}{2}$	2 2 $\frac{1}{2}$	2 8 $\frac{3}{8}$	...	...	16 10	Set off $\frac{1}{2}$ in.
Frampton	Masonry (brick cap.)	2 4 $\frac{1}{2}$	2 1 $\frac{1}{2}$	2 8 $\frac{3}{8}$	...	...	22 10	
Bethunga	"	2 7 $\frac{1}{2}$	2 2 $\frac{1}{2}$	3 4 $\frac{3}{8}$	...	...	23 10	
Illabo	"	2 5 $\frac{1}{2}$	2 2	2 9 $\frac{3}{8}$	...	...	24 10	
Junee Junction	Brick (stone cap.)	2 8	2 3 $\frac{3}{8}$	2 8	...	...	9 8	
"	Masonry (brick cap.)	2 3 $\frac{1}{2}$	2 1	2 10 $\frac{1}{2}$	...	...	9 8	
"	Brick (stone cap.)	2 7 $\frac{1}{2}$	2 2 $\frac{1}{2}$	2 7 $\frac{1}{2}$	...	...	9 8	
"	Masonry (brick cap.)	2 4 $\frac{1}{2}$	2 1 $\frac{1}{2}$	2 10 $\frac{1}{2}$	...	...	9 8	
"	Brick (stone cap.)	2 9	2 3	2 8 $\frac{1}{2}$	...	...	9 8	
"	Masonry (brick cap.)	2 4 $\frac{1}{2}$	2 2 $\frac{1}{2}$	2 9 $\frac{3}{8}$	...	...	9 8	
Harefield	"	2 5	2 2 $\frac{1}{2}$	2 9 $\frac{1}{4}$	...	...	32 8	
Bomen	Masonry (brick cap.)	2 4 $\frac{1}{2}$	2 1 $\frac{1}{2}$	2 8 $\frac{3}{8}$	...	...	32 8	
Wagga Wagga	Brick	2 5 $\frac{1}{2}$	2 1 $\frac{1}{2}$	2 9 $\frac{1}{2}$	...	...	34 8	
Sandy Creek	Timber	2 6	2 3 $\frac{1}{2}$	2 9 $\frac{1}{2}$	...	...	35 8	
The Rock	"	2 5 $\frac{1}{2}$	2 4	2 9 $\frac{1}{2}$	...	...	36 8	
Yerong Creek	"	2 6 $\frac{1}{2}$	2 5 $\frac{3}{8}$	2 10 $\frac{1}{2}$	...	...	38 8	
Doodle, Cooma	Masonry	2 6 $\frac{1}{2}$	2 3 $\frac{1}{2}$	2 8 $\frac{3}{8}$	...	...	38 8	
Culcairn	Brick (stone cap.)	2 7 $\frac{1}{2}$	2 2 $\frac{1}{2}$	3 5 $\frac{3}{8}$	...	...	39 8	Dished 1 $\frac{1}{2}$ in.
"	Timber	2 2 $\frac{1}{2}$	2 0 $\frac{1}{2}$	2 6 $\frac{3}{8}$	...	...	39 8	
Gerogery	"	2 3 $\frac{3}{8}$	2 2 $\frac{3}{8}$	2 6 $\frac{1}{2}$	...	...	40 8	
Yambla	Brick	2 5	2 3 $\frac{1}{2}$	2 8 $\frac{3}{8}$	...	...	9 10	
Ettamogah	"	2 8	2 3 $\frac{1}{2}$	2 7 $\frac{1}{2}$	...	...	11 10	
Albury Racecourse	Timber	2 5 $\frac{1}{2}$	2 11 $\frac{1}{2}$	2 10 $\frac{1}{2}$	...	...	12 10	6 in. x 6 in. piles.
Albury	Brick (stone cap.)	2 7 $\frac{1}{2}$	2 7 $\frac{1}{2}$	2 9 $\frac{1}{2}$	...	...	1 10	Set off 2 $\frac{1}{2}$ in.

GREAT SOUTHERN RAILWAY—COOTAMUNDRA TO GUNDAGAI.

Brawlin	Timber	2 7	2 5 $\frac{1}{2}$	2 7 $\frac{1}{2}$	...	...	30 10
Muttama	"	2 9 $\frac{1}{2}$	2 5 $\frac{1}{2}$	2 8 $\frac{3}{8}$	...	...	29 10
Coolac	"	2 8 $\frac{1}{2}$	2 5	2 8	...	...	29 10
Gundagai	"	2 5 $\frac{1}{2}$	2 4 $\frac{1}{2}$	2 5 $\frac{7}{8}$	...	...	25 10

Name of Station.	Description of Platform.	Measurements.			Cant.		No. and page in Field Book.	Remarks.
		Top.	Bottom.	Height from rail.	In.	Out.		

GREAT SOUTHERN RAILWAY—NARRANDERA TO JERILDERIE.

		ft.	in.	ft.	in.	ft.	in.	in.	in.	Page.	No.	
Gillenbah	Old sleepers	2	6½	2	6½	3	6½	15	8	6 in. x 6 in. piles.
Cuddell	Masonry (brick cap.) ...	2	7½	2	4½	2	8½	...	...	15	8
Colombo Creek	Timber	2	5	2	3½	2	8½	1½	...	16	8	
Widgieva	"	2	6½	2	10½	2	8½	...	...	17	8
Coonong	"	2	2½	1	11½	2	10½	...	...	17	8
Bundure	"	2	2¾	2	0½	2	7½	1	...	20	8	
Yatbong	"	2	4	2	2½	2	1½	...	...	19	1
Jerilderie	Brick	2	5½	2	2½	2	8½	...	...	18	1

GREAT SOUTHERN RAILWAY—COOMA BRANCH.

		2	7	2	2½	2	9½	95	1	
Bangalore	Brick	2	7	2	2½	2	9½	95	1	Dished 1¼ in.
Lake Bathurst	"	2	7	2	4½	2	5	1½	...	96	1	
Tarago	"	2	6¾	2	4½	2	8½	98	1	Set off 1½ in.
Lake Bathurst (on Lake) ...	"	2	8	2	5½	2	9½	2½	...	100	1	
Fairy Meadow	"	2	7½	2	4½	2	9½	...	...	101	1
Bungendore	"	2	6½	2	3½	2	9½	...	...	103	1
Burbong	Concrets (brick cap.) ...	2	4½	2	1½	2	10	½	...	107	1	Set off ½ in.
Queanbeyan	Brick	2	7½	2	4	2	9½	...	...	136	1
Tuggeranong	Timber	2	6½	2	3½	2	10½	...	...	133	1
Rob Roy	"	2	5¾	2	4	2	10½	...	...	132	1
Michelago	Brick	2	7½	2	4½	2	9½	...	...	129	1
Colinton	"	2	7	2	3½	2	9½	...	...	125	1
Bredbo	"	2	7½	2	4½	2	9½	1½	...	121	1	
Umeralla	"	2	7½	2	4½	2	9½	1½	...	117	1	
Bunyan	"	2	6½	2	4	2	10½	116	1	
Cooma	"	2	7½	2	4½	2	9½	...	...	110	1

GREAT SOUTHERN RAILWAY—DEMONDRILLE TO BLAYNEY.

Kingsvale	Brick.....	2	7 ³ / ₈	2	4 ¹ / ₂	2	9 ³ / ₄	...	...	6	1	Set off 1 ¹ / ₂ in.
"	"	2	6 ¹ / ₂	2	5	2	9 ³ / ₄	...	...	6	1	
Young.....	Brick (stone cap.)	2	6 ¹ / ₂	2	6 ¹ / ₂	2	10 ³ / ₄	...	...	12	1	Set off 1 in.
Burrangong	Old sleepers.....	2	6 ¹ / ₂	2	8 ¹ / ₂	2	10 ³ / ₄	...	1	16	1	
Burrangong, Monteagle ...	"	2	8 ¹ / ₂	2	9 ¹ / ₂	3	2 ¹ / ₂	...	...	16	1	
Monteagle	Timber	2	7	2	3 ³ / ₄	2	11 ¹ / ₂	...	...	17	1	
Bendick Morrell	Brick	2	7 ¹ / ₈	2	5 ⁵ / ₈	2	9 ³ / ₈	...	³ / ₄	18	1	
Crowther.....	Old sleepers	2	6	2	7 ³ / ₈	7	7 ¹ / ₂	...	...	19	1	
Koorawatha	Timber	2	6	2	3	3	0 ¹ / ₂	...	...	20	1	
Cowra	Brick	2	7 ¹ / ₈	2	5 ¹ / ₂	2	9 ³ / ₈	...	...	25	1	
Holmwood	Timber	2	6 ¹ / ₂	2	3 ¹ / ₂	2	10 ¹ / ₂	...	...	41	1	
Holmwood, Woodstock	"	2	4 ¹ / ₂	2	2 ¹ / ₂	2	10 ¹ / ₂	1 ¹ / ₂	...	43	1	
Woodstock	"	2	8 ¹ / ₂	2	4	2	11	1 ¹ / ₂	...	42	1	
Wyalla	"	2	6 ¹ / ₂	2	3 ¹ / ₂	2	7 ¹ / ₂	3 ¹ / ₄	...	40	1	
Garland	Brick	2	8 ¹ / ₂	2	5 ¹ / ₂	3	0 ¹ / ₂	...	...	39	1	
Lyndhurst	"	2	8 ¹ / ₂	2	5 ¹ / ₂	2	11 ¹ / ₂	...	...	57	1	
Mandurama	Timber	2	8 ¹ / ₂	2	9 ³ / ₈	3	4 ¹ / ₂	...	³ / ₄	36	1	
Carcoar	Brick	2	7 ¹ / ₂	2	4 ¹ / ₂	2	9 ¹ / ₂	...	...	33	1	
Blayney	"	2	7 ¹ / ₄	2	5 ⁵ / ₈	2	10 ³ / ₄	...	...	30	1	

SOUTH-WESTERN LINE—JUNEE JUNCTION TO HAY.

Old Junee	Masonry (brick cap.) ...	2	5½	2	3½	2	9½	10	8	6 in. x 6 in. piles.
Marrar	Timber	2	4½	2	10½	2	8½	...	...	11	8
Coolaman	Masonry (brick cap.) ...	2	7½	2	6½	2	8½	...	...	11	8
Boggy Creek	Old sleepers.....	2	8½	2	9½	2	7½	...	...	12	8
Devlin's Siding	Timber	2	5½	2	9½	3	0	...	...	12	8
Grong Grong	Masonry (brick cap.) ...	2	6½	2	2½	2	9½	...	...	12	8
Narrandera	Masonry	2	6½	2	2½	2	10½	...	1½	13	8	
Yanko Siding.....	Old sleepers.....	2	5½	2	11	2	6½	...	¾	29	8	
Whitton	Timber	2	3	2	2½	2	8½	...	...	29	8
Darlington	"	2	6	2	3½	2	5	...	...	28	8
Benerembah	"	2	4½	2	7	2	5	...	...	26	8
Bringagee	Old sleepers	2	5½	2	6½	2	10½	1½	...	26	8	
Groongal	"	2	6½	2	4½	2	5½	...	...	25	8
Carrathool	Timber	2	3½	2	3½	2	5½	...	...	24	8

SOUTH-WESTERN LINE—JUNEE JUNCTION TO HAY—continued.

SOUTH WESTERN											
Uardry	Old sleepers	2	11½	3	3¼	2	10½	...	...	24	8
Tnononga	"	2	9½	3	1¼	2	10	...	½	23	8
Beabula	"	2	6½	3	0½	2	9	...	½	23	8
Hay	Brick	2	5¼	2	4½	2	5¼	...	...	20	8

Name of Station.	Description of Platform.	Measurements.			Cant.		No. and page, in Field Book.	Remarks.
		Top.	Bottom.	Height from rail.	In	Out.		

GREAT NORTHERN RAILWAY.								
		ft. in.	ft. in.	ft. in.	in.	in.	Page. No.	
Wallangarra	Concrete (wood cap.) ...	2 6	2 3 $\frac{1}{2}$	2 9 $\frac{1}{2}$	...	...	188 2	
Sunnyside ...	Brick.....	2 6 $\frac{1}{2}$	2 3 $\frac{1}{2}$	2 11 $\frac{1}{2}$	...	...	133 2	
Tenterfield	"	2 8	2 5 $\frac{1}{2}$	2 10 $\frac{1}{2}$	...	...	126 2	
Bluff Rock	Timber	2 10 $\frac{1}{2}$	2 9 $\frac{1}{2}$	2 8 $\frac{1}{2}$	...	...	125 2	
Sandy Flat.....	Brick.....	2 7 $\frac{1}{2}$	2 4 $\frac{1}{2}$	2 8 $\frac{1}{2}$	...	...	124 2	
Bolivia	"	2 6 $\frac{3}{4}$	2 4	3 4 $\frac{3}{8}$	...	...	123 2	
Deepwater	"	2 6 $\frac{3}{4}$	2 5 $\frac{3}{4}$	2 10 $\frac{1}{2}$	...	...	122 2	
Dundee	"	2 6 $\frac{3}{4}$	2 4 $\frac{3}{4}$	2 10	...	...	118 2	
Yarrowford	"	2 7 $\frac{1}{2}$	2 4 $\frac{3}{4}$	2 10 $\frac{1}{2}$	...	...	116 2	
Glen Innes	Brick (stone cap.)	2 7 $\frac{1}{2}$	2 4 $\frac{1}{2}$	3 0 $\frac{1}{2}$	...	...	113 2	
Stonehenge.....	Timber	2 5 $\frac{1}{2}$	2 6 $\frac{1}{2}$	2 5 $\frac{1}{2}$	...	...	110 2	
Glencoe	Brick.....	2 6	2 3	2 11 $\frac{1}{2}$	...	...	107 2	
Ben Lomond	"	2 6 $\frac{3}{4}$	2 4	2 9 $\frac{1}{2}$	...	...	106 2	
Llangothlin	Timber	2 4 $\frac{3}{4}$	2 5 $\frac{1}{2}$	2 9	...	...	140 2	
Guyra.....	Brick.....	2 6 $\frac{3}{4}$	2 5 $\frac{1}{4}$	2 9 $\frac{3}{8}$	...	...	141 2	Set off $\frac{1}{2}$ in.
Black Mountain.....	Timber	2 6 $\frac{1}{2}$	2 2 $\frac{1}{2}$	2 9 $\frac{1}{2}$	...	...	145 2	
Duval	"	2 8	3 2 $\frac{3}{8}$	2 5 $\frac{1}{2}$	...	...	146 2	
Dumaresq	Brick.....	2 7 $\frac{1}{4}$	2 5 $\frac{1}{4}$	2 9 $\frac{1}{2}$	...	...	147 2	
Armidale.....	Brick (stone cap.)	2 6 $\frac{3}{4}$	2 5 $\frac{1}{4}$	2 11 $\frac{1}{8}$	...	...	150 2	
Kelly's Plains.....	Timber	2 4 $\frac{1}{2}$	2 6 $\frac{1}{2}$	2 7 $\frac{1}{2}$	...	...	1 3	
Uralla	Brick.....	2 5 $\frac{1}{2}$	2 3 $\frac{1}{2}$	2 8 $\frac{1}{2}$	...	...	5 3	Set off $\frac{1}{2}$ in.
Kentucky	"	2 6	2 3 $\frac{1}{2}$	2 8 $\frac{1}{2}$	1 $\frac{1}{2}$	...	7 3	Set off $\frac{1}{2}$ in.
Wollar	Timber	2 5 $\frac{1}{2}$	2 6 $\frac{3}{8}$	2 11 $\frac{1}{2}$	...	...	8 3	
Walcha Road.....	Brick.....	2 8 $\frac{1}{2}$	2 9 $\frac{1}{2}$	2 8 $\frac{1}{2}$	...	...	9 3	Double set off 1 $\frac{1}{2}$ in., 1 $\frac{1}{2}$ in.
M'Donald River.....	Timber	2 4	2 4 $\frac{3}{8}$	2 10 $\frac{3}{8}$	...	...	13 3	
Farquharson Siding	"	2 4 $\frac{1}{2}$	2 5	2 9 $\frac{1}{2}$	...	...	16 3	
Moonbi	"	2 3	2 1 $\frac{1}{2}$	2 11 $\frac{1}{2}$	...	...	17 3	
Tintinhull	"	2 2 $\frac{3}{4}$	2 4 $\frac{1}{2}$	2 10 $\frac{1}{2}$	...	...	18 3	
Tamworth	Brick.....	2 4 $\frac{1}{2}$	2 0 $\frac{1}{2}$	2 6 $\frac{1}{2}$	...	...	21 3	
West Tamworth	"	2 4 $\frac{1}{2}$	2 2	2 8 $\frac{1}{2}$	...	...	29 3	
Duri	"	2 3 $\frac{3}{4}$	2 2	2 1 $\frac{1}{2}$	...	...	31 3	
Curraubula	Masonry (brick cap.) ...	2 6 $\frac{1}{4}$	2 2	2 9 $\frac{1}{2}$	...	...	32 3	
Werris Creek	Brick	2 3 $\frac{3}{4}$	1 9 $\frac{1}{4}$	2 9 $\frac{1}{2}$	...	...	35 3	Dished 2 in.
"	"	2 5	1 11 $\frac{3}{8}$	2 9 $\frac{1}{4}$	...	...	34 3	Dished 2 $\frac{1}{2}$ in.
Quipolly	Masonry (brick cap.) ...	2 5	2 2 $\frac{1}{4}$	2 6 $\frac{1}{4}$	...	...	37 3	
Quirindi	Timber	2 4 $\frac{3}{8}$	2 2	2 10	...	...	38 3	
Braefield	"	2 4	2 3 $\frac{1}{2}$	2 2 $\frac{3}{8}$	...	...	43 3	
Willow Tree	"	2 3 $\frac{1}{8}$	2 2 $\frac{1}{2}$	2 8 $\frac{1}{2}$	...	...	44 3	
Doughboy Hollow.....	Brick	2 5 $\frac{1}{2}$	2 4 $\frac{1}{2}$	2 2 $\frac{3}{4}$	...	...	47 3	
Temple Court.....	"	2 5 $\frac{1}{2}$	2 2 $\frac{1}{2}$	2 5 $\frac{1}{2}$	...	...	51 3	
Murrurundi	Brick (stone cap.)	2 1 $\frac{3}{4}$	2 0	2 4	...	...	56 3	
Blandford	"	2 5 $\frac{1}{2}$	2 3 $\frac{1}{4}$	2 8	1 $\frac{3}{8}$	...	57 3	
Wingen	Brick	2 4 $\frac{1}{2}$	2 3 $\frac{1}{4}$	2 9 $\frac{1}{4}$	...	...	60 3	
Parkville	"	2 6 $\frac{7}{8}$	2 4 $\frac{1}{2}$	2 10 $\frac{7}{8}$	...	...	61 3	
Score	Brick (stone cap.)	2 5 $\frac{1}{2}$	2 2 $\frac{3}{8}$	2 7 $\frac{1}{2}$	...	...	61 3	
Aberdeen.....	Brick	2 4 $\frac{1}{2}$	2 2 $\frac{1}{2}$	2 10 $\frac{1}{2}$	...	...	66 3	
Muswellbrook	Brick (stone cap.)	2 3 $\frac{3}{8}$	2 1 $\frac{1}{2}$	2 7 $\frac{3}{8}$	...	...	68 3	
Grass Tree	Brick	2 4 $\frac{1}{2}$	2 5 $\frac{1}{4}$	2 4 $\frac{1}{2}$	...	...	74 3	
Liddell	"	2 6 $\frac{3}{8}$	2 4 $\frac{1}{2}$	2 5 $\frac{3}{8}$	...	...	74 3	
Ravensworth	Brick (stone cap.)	2 5 $\frac{3}{4}$	2 3 $\frac{3}{4}$	2 8	1 $\frac{1}{4}$	...	75 3	
Glennie's Creek	Brick	2 4 $\frac{1}{2}$	2 5 $\frac{1}{2}$	2 8 $\frac{1}{2}$	...	...	78 3	
Rix's Creek	"	2 5 $\frac{1}{2}$	2 2 $\frac{1}{2}$	3 0	1 $\frac{1}{4}$	...	79 3	
Singleton	Timber	2 7 $\frac{1}{2}$	2 9 $\frac{1}{2}$	2 10 $\frac{1}{2}$	...	...	80 3	9-in. piles.
Whittingham	Brick	2 4	2 4 $\frac{1}{2}$	2 8 $\frac{1}{2}$	...	...	87 3	
Belford	"	2 3 $\frac{3}{8}$	2 3 $\frac{1}{2}$	2 9 $\frac{1}{2}$	2	...	89 3	
Branxton	Timber	2 5 $\frac{1}{4}$	2 6 $\frac{1}{4}$	2 10 $\frac{1}{4}$	...	...	94 3	6 in. x 6 in. piles.
Greta	Brick	2 5 $\frac{1}{2}$	2 5 $\frac{3}{8}$	2 9 $\frac{1}{2}$	1 $\frac{1}{2}$	...	97 3	
Allandale	"	2 4	2 3 $\frac{1}{2}$	2 10 $\frac{1}{2}$	2 $\frac{1}{2}$	...	99 3	
"	"	2 6 $\frac{1}{4}$	2 4 $\frac{1}{2}$	2 10 $\frac{1}{2}$	1 $\frac{1}{4}$	...	99 3	
Lochinvar	"	2 4	2 5 $\frac{1}{2}$	2 8 $\frac{1}{4}$	...	...	101 3	
Lochinvar-Farley	Timber	2 6 $\frac{1}{2}$	2 6 $\frac{1}{2}$	2 9 $\frac{1}{2}$	1 $\frac{1}{2}$	...	104 3	
Farley	Brick	2 4 $\frac{1}{2}$	2 4 $\frac{1}{2}$	2 7 $\frac{1}{2}$	...	...	106 3	Set off $\frac{1}{2}$ in.
West Maitland	Brick (stone cap.)	2 5 $\frac{1}{2}$	2 1 $\frac{3}{8}$	2 9 $\frac{1}{2}$	...	...	108 3	Dished 2 in.
High-street (up line)	Timber	2 4 $\frac{1}{2}$	2 9	2 10 $\frac{3}{8}$	1 $\frac{1}{2}$	...	112 3	8 in. x 8 in. piles 20 ft. 9 in.
" (down line)	"	2 5	2 9 $\frac{3}{4}$	2 7 $\frac{3}{4}$	1	...	112 3	8 in. x 8 in. piles 20 ft. 9 in.
East Maitland (up line)	Brick	2 7 $\frac{1}{2}$	2 2 $\frac{3}{4}$	2 7 $\frac{1}{2}$	2 $\frac{1}{2}$	...	113 3	Dished 1 $\frac{1}{2}$ in.
" (down line)	Timber	2 3 $\frac{3}{4}$	2 9 $\frac{1}{4}$	2 10 $\frac{3}{8}$	1 $\frac{1}{2}$	...	113 3	7 in. x 7 in. piles 21 ft. 0 in.
" (up line)	"	2 6	2 11 $\frac{1}{2}$	2 8 $\frac{1}{2}$	2 $\frac{1}{2}$	...	113 3	6 in. x 6 in. piles 21 ft. 0 in.
" (Morpeth branch)	"	2 4 $\frac{3}{4}$	3 0	3 4 $\frac{1}{2}$	2 $\frac{1}{2}$	...	114 3	6 in. x 6 in. piles.
Victoria-street (up line)	Brick	2 7 $\frac{1}{2}$	2 4 $\frac{3}{8}$	3 0 $\frac{1}{2}$	...	...	129 3	Dished 1 $\frac{1}{2}$ in. 20 ft. 6 in.
" (down line)	"	2 3 $\frac{1}{4}$	2 2	2 7 $\frac{3}{4}$	1	...	129 3	
Victoria-street-Thornton	Timber	2 8	2 5 $\frac{1}{2}$	2 9 $\frac{1}{4}$	2 $\frac{1}{2}$	...	130 3	
Thornton (up line)	Brick	2 4 $\frac{1}{2}$	2 2 $\frac{1}{2}$	3 1 $\frac{1}{2}$	...	...	131 3	
" (down line)	"	2 2 $\frac{1}{2}$	2 2 $\frac{3}{8}$	2 5 $\frac{1}{2}$	...	...	131 3	} 20 ft. 4 in.
Tarro (down line)	"	2 7 $\frac{1}{4}$	2 4 $\frac{3}{4}$	2 10 $\frac{3}{4}$	...	...	133 3	
" (up line)	"	2 5 $\frac{1}{2}$	2 1 $\frac{1}{2}$	2 11 $\frac{1}{2}$	...	...	133 3	
Hexham (down line)	Timber	2 3 $\frac{1}{2}$	2 5 $\frac{1}{2}$	2 11 $\frac{1}{4}$	...	...	136 3	
" (up line)	Brick	2 5	2 3 $\frac{3}{8}$	2 11	...	...	137 3	
Sandgate (up line)	Brick.....	2 5 $\frac{1}{2}$	2 1 $\frac{3}{8}$	2 8 $\frac{1}{2}$	...	...	138 3	Dished 2 in. }
" (down line)	"	2 6 $\frac{1}{2}$	2 3	2 6 $\frac{1}{2}$	...	...	138 3	Dished 1 $\frac{1}{2}$ in. } 20 ft. 8 $\frac{1}{2}$ in.
Waratah (up line)	Timber	2 4 $\frac{3}{8}$	2 7	2 7 $\frac{3}{4}$	...	...	139 3	} 20 ft. 8 in.
" (down line)	"	2 3 $\frac{3}{8}$	2 9 $\frac{1}{2}$	2 6 $\frac{1}{4}$	...	...	139 3	
" (up line)	Brick	2 4 $\frac{3}{8}$	2 2 $\frac{1}{2}$	2 8 $\frac{1}{2}$	...	...	140 3	Dished 1 $\frac{1}{2}$ in. }
" (down line)	"	2 5 $\frac{1}{2}$	2 1 $\frac{1}{2}$	2 8 $\frac{3}{8}$	...	...	140 3	Dished 1 $\frac{1}{2}$ in. } 20 ft. 10 $\frac{1}{4}$ in.

Name of Station.	Description of Platform.	Measurements.			Cant.		No. and page in Field Book.	Remarks.
		Top.	Bottom.	Height from rail.	In.	Out.		

GREAT NORTHERN RAILWAY—continued.

		ft.	in.	ft.	in.	ft.	in.	ir.	in.	Page.	No.	
Hamilton (up line)	"	2	3 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	7 $\frac{1}{2}$	145	3	} 20 ft. 6 $\frac{1}{2}$ in.
" (down line)	"	2	3 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	7 $\frac{1}{2}$	...	1 $\frac{1}{2}$	145	3
Newcastle	Brick (stone cap.)	2	3 $\frac{1}{2}$	2	5	2	7 $\frac{1}{2}$	1	...	18	4	} Set off 2 in. Set off 2 in. } 31 ft. 4 $\frac{1}{2}$ in. Set off 2 in. } 7 in. x 7 in. piles.
"	"	2	2 $\frac{1}{2}$	2	4	2	8 $\frac{1}{2}$	...	...	19	4
"	"	2	3 $\frac{1}{2}$	2	3 $\frac{1}{2}$	2	9 $\frac{1}{2}$	...	...	19	4
Mortuary	Timber	2	7 $\frac{1}{2}$	3	0 $\frac{1}{2}$	3	1 $\frac{1}{2}$...	2 $\frac{3}{8}$	1	4	} 7 in. x 7 in. piles.
Honeysuckle Point	Brick (stone cap.)	2	4	2	2	2	7 $\frac{1}{2}$	...	...	148	3
" (up line)	"	2	5 $\frac{1}{2}$	2	2 $\frac{1}{2}$	2	7 $\frac{1}{2}$	148	3	} 20 ft. 10 $\frac{1}{2}$ in. 21 ft. 0 $\frac{1}{2}$ in. 7 in. x 7 in. piles.
Junction	Brick	2	8 $\frac{1}{2}$	2	6	3	1 $\frac{1}{2}$	...	2 $\frac{3}{8}$	21	4
"	"	2	7	2	4 $\frac{1}{2}$	2	9 $\frac{1}{2}$	...	2 $\frac{3}{8}$	20	4
Adamstown (up line)	"	2	6 $\frac{3}{8}$	2	4 $\frac{1}{2}$	2	9 $\frac{1}{2}$	...	...	21	4
" (down line)	"	2	5 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	7 $\frac{1}{2}$	...	...	21	4
Broadmeadow (down line)	Timber	2	6 $\frac{3}{8}$	2	4	2	10	...	...	17	4
" (up line)	Brick	2	6 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	10 $\frac{1}{2}$	...	...	17	4
Cardiff	Timber	2	5 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	7 $\frac{1}{2}$	...	...	23	4
Cockle Creek	"	2	7	2	5 $\frac{1}{2}$	2	9 $\frac{1}{2}$	...	1 $\frac{7}{8}$	24	4
"	"	2	8	2	6 $\frac{1}{2}$	2	8 $\frac{1}{2}$	1 $\frac{1}{2}$	...	24	4
Teralba	"	2	7 $\frac{1}{2}$	2	6	2	6 $\frac{1}{2}$	1 $\frac{1}{4}$...	26	4	} 7 in. x 7 in. piles.
Fassifern	Concrete (wood cap.)	2	7 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	9 $\frac{1}{2}$	2	...	27	4	
Awaba	Timber	2	7 $\frac{1}{2}$	2	5 $\frac{1}{2}$	2	11 $\frac{1}{2}$	1 $\frac{1}{2}$	...	28	4
Dora Creek	"	2	5 $\frac{1}{2}$	2	10 $\frac{1}{2}$	2	9	...	...	30	4
Morrisset	Concrete (wood cap.)	2	7 $\frac{1}{2}$	2	5 $\frac{1}{2}$	2	10 $\frac{1}{2}$	...	...	32	4
Wye	Timber	2	7 $\frac{1}{2}$	2	5 $\frac{1}{2}$	2	10 $\frac{1}{2}$	...	...	33	4
Wyong	"	2	8 $\frac{1}{2}$	2	3 $\frac{1}{2}$	2	9	...	1 $\frac{1}{2}$	36	4	
Tuggerah Lakes	"	2	6 $\frac{1}{2}$	2	3 $\frac{1}{2}$	2	9 $\frac{1}{2}$	...	...	38	4
Ourimbah	"	2	7 $\frac{1}{2}$	2	5 $\frac{1}{2}$	2	8 $\frac{1}{2}$	...	1	40	4
Narrara	Brick (stone cap.)	2	8	2	5 $\frac{1}{2}$	2	9 $\frac{1}{2}$	...	...	40	4
Gosford	Brick	2	7 $\frac{1}{2}$	2	4 $\frac{1}{2}$	3	0 $\frac{1}{2}$	44	4	} 82 ft. 0 $\frac{1}{2}$ in. 6 in. x 6 in. piles. 6 in. x 6 in. piles. 21 ft. 0 $\frac{1}{2}$ in. 6 in. x 6 in. piles, 21 ft. 3 $\frac{1}{2}$ in. 6 in. x 6 in. piles, 21 ft. 3 $\frac{1}{2}$ in.
"	Timber	2	7 $\frac{1}{2}$	2	5 $\frac{1}{2}$	3	0 $\frac{1}{2}$	...	...	44	4
Point Clare	Timber	2	9	3	1 $\frac{1}{2}$	2	10 $\frac{1}{2}$	...	...	46	4
Woy Woy	"	2	7 $\frac{1}{2}$	2	10	2	11 $\frac{1}{2}$	...	2 $\frac{1}{2}$	47	4
Mullet Creek	Old sleepers	2	5 $\frac{1}{2}$	2	10 $\frac{1}{2}$	2	11 $\frac{1}{2}$	...	2 $\frac{1}{2}$	49	4
Long Island	Brick	2	6 $\frac{1}{2}$	2	4 $\frac{1}{2}$	3	3 $\frac{1}{2}$	...	...	52	4
"	"	2	6 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	9 $\frac{1}{2}$	...	...	52	4
Hawkesbury River (up line)	Timber	2	7 $\frac{1}{2}$	2	9 $\frac{1}{2}$	3	0 $\frac{1}{2}$	...	...	53	4
" (down line)	"	2	8 $\frac{1}{2}$	2	10	3	5 $\frac{1}{2}$	2 $\frac{1}{2}$	...	53	4
Berowra	Brick	2	8	2	5	2	11 $\frac{1}{2}$	...	...	61	4
Colah	"	2	7 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	9 $\frac{1}{2}$...	1 $\frac{1}{2}$	61	4	} 5 in. x 5 in. piles.
Hornsby	"	2	7 $\frac{3}{4}$	2	5 $\frac{1}{4}$	2	8	...	...	63	4
Thornleigh	"	2	10	2	7 $\frac{1}{2}$	2	9 $\frac{1}{2}$	...	...	87	4
Pennant Hills	"	2	7 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	9 $\frac{1}{2}$	...	...	91	4
Beecroft	"	2	5 $\frac{3}{4}$	2	4	2	9 $\frac{1}{2}$	...	4 $\frac{1}{2}$	93	4
Carlingford	"	2	9	2	5 $\frac{1}{2}$	2	11 $\frac{1}{2}$	...	1 $\frac{1}{2}$	94	4
Eastwood	Timber	2	7	3	4	3	5 $\frac{1}{2}$	...	...	96	4
Ryde	Brick	2	7	2	4 $\frac{1}{2}$	2	9 $\frac{1}{2}$	...	1 $\frac{1}{2}$	99	4
Meadowbank	"	2	7 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	11 $\frac{1}{2}$	1 $\frac{1}{2}$	...	100	4
Rhodes	Timber	2	6 $\frac{1}{2}$	2	3 $\frac{1}{2}$	2	10 $\frac{1}{2}$	...	...	101	4
Concord	Brick	2	7 $\frac{1}{2}$	2	3 $\frac{1}{2}$	2	11 $\frac{1}{2}$	...	2	162	4

GREAT NORTHERN RAILWAY—ST. LEONARDS BRANCH.

Wahroonga	Concrete (wood cap.)	2	8 $\frac{1}{2}$	2	5 $\frac{1}{2}$	2	9 $\frac{1}{2}$	...	...	61	4
Turrumurra	"	2	7 $\frac{1}{2}$	2	5	2	9 $\frac{1}{2}$	...	...	64	4
Pymble	Brick	2	7 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	10 $\frac{1}{2}$	...	...	65	4
Gordon	Concrete (wood cap.)	2	7 $\frac{1}{2}$	2	4	2	10 $\frac{1}{2}$	...	...	70	4
Lindfield	"	2	7 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	10 $\frac{1}{2}$	1 $\frac{1}{2}$	...	75	4
Rossville	"	2	8 $\frac{1}{2}$	2	5 $\frac{1}{2}$	2	11 $\frac{1}{2}$	...	...	77	4
Chatswood	"	2	7	2	4 $\frac{1}{2}$	2	10 $\frac{1}{2}$	...	...	80	4
St. Leonards	Brick	2	7 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	10 $\frac{1}{2}$	...	...	83	4

NORTH-WESTERN RAILWAY.

Narrabri	Brick	2	7 $\frac{3}{8}$	2	4 $\frac{1}{2}$	2	10	...	...	85	2
Tibberena	Timber	2	7 $\frac{1}{4}$	2	10 $\frac{1}{8}$	3	4 $\frac{3}{4}$	...	...	88	2
Turrawan	"	2	4	2	7 $\frac{1}{4}$	2	7 $\frac{3}{8}$	...	...	89	2
Baan Baa	"	2	5 $\frac{1}{2}$	2	8 $\frac{1}{4}$	2	11 $\frac{1}{8}$	...	...	90	2
Boggabri	Brick	2	5 $\frac{1}{2}$	2	3 $\frac{1}{2}$	2	9 $\frac{1}{4}$	...	...	92	2
Emerald Hill	Timber	2	5 $\frac{1}{2}$	2	7 $\frac{1}{2}$	3	2 $\frac{1}{4}$	...	...	94	2
Gunnedah	Brick	2	2 $\frac{3}{4}$	2	1	2	7 $\frac{3}{8}$	...	...	97	2
Curlewis	Timber	2	3 $\frac{1}{2}$	2	2 $\frac{3}{4}$	2	5 $\frac{1}{2}$	...	...	101	2
Breeza	Brick	2	2 $\frac{1}{2}$	2	1 $\frac{3}{4}$	2	6 $\frac{3}{8}$	...	...	102	2
Gap	Timber	2	3 $\frac{3}{8}$	2	2 $\frac{3}{8}$	2	4 $\frac{3}{8}$	...	...	105	2
Wallsend	Brick	2	4	2	4 $\frac{1}{2}$	3	5 $\frac{3}{8}$	...	...	143	3

MORPETH BRANCH.

Raworth	Brick	2	6 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	10 $\frac{1}{2}$	1 $\frac{1}{2}$	...	118	3
Morpeth	Brick (stone cap.)	2	5 $\frac{1}{4}$	2	2 $\frac{1}{2}$	2	9	...	...	119	3
"	Brick	2	7	2	4 $\frac{1}{2}$	3	1	...	...	120	3
"	Brick (stone cap.)	2	1 $\frac{3}{4}$	1	7 $\frac{1}{2}$	2	10	...	...	124	3

Name of Station	Description of Platform.	Measurements.			Cant.		No. and page in Field Book.	Remarks.
		Top.	Bottom.	Height from rail.	In.	Out.		

SOUTH COAST RAILWAY.

		ft.	in.	ft.	in.	ft.	in.	in.	in.	Page.	No.	
Kiama	Timber	2	7 $\frac{1}{2}$	2	5 $\frac{1}{2}$	2	9 $\frac{3}{8}$	152	4	6 in. x 6 in. piles.
Shellharbour	"	2	6 $\frac{1}{2}$	2	8 $\frac{3}{8}$	3	0 $\frac{1}{2}$	...	...	147	4
Albion Park	Brick	2	8 $\frac{3}{8}$	2	5 $\frac{1}{2}$	2	8 $\frac{3}{8}$	...	1 $\frac{1}{2}$	145	4
Yallah	"	2	8 $\frac{1}{2}$	2	5	2	10 $\frac{1}{2}$...	1 $\frac{1}{2}$	142	4	6 in. x 6 in. piles.
Dapto	"	2	7 $\frac{1}{2}$	2	5	2	9 $\frac{3}{8}$	...	...	140	4
Kembla Grange	Timber	2	7	2	11 $\frac{1}{2}$	2	9 $\frac{1}{2}$	1	...	138	4	
Unanderra	Brick	2	6 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	11 $\frac{3}{8}$	1	...	137	4	1 in. set off.
Wollongong	Brick (stone cap.)	2	7 $\frac{1}{2}$	2	6 $\frac{1}{2}$	2	10 $\frac{3}{8}$	...	...	132	4
Para Meadow	Brick	2	8 $\frac{1}{2}$	2	5	2	10 $\frac{3}{8}$	...	...	131	4
Corrimal	"	2	8 $\frac{1}{2}$	2	6 $\frac{3}{8}$	2	8 $\frac{3}{8}$	129	4	6 in. x 6 in. piles.
Bellambi	"	2	9 $\frac{1}{2}$	2	5 $\frac{3}{8}$	2	11	...	...	128	4
Bulli	Timber	2	5 $\frac{1}{2}$	2	2 $\frac{3}{8}$	2	11	...	...	126	4
Robinsville	"	2	7	2	3 $\frac{3}{8}$	2	11	123	4	6 in. x 6 in. piles.
Austinmer	Brick	2	7 $\frac{3}{8}$	2	4 $\frac{1}{2}$	2	7 $\frac{3}{8}$	...	...	122	4
Clifton South	Timber	2	7 $\frac{1}{2}$	2	3 $\frac{3}{8}$	2	9 $\frac{1}{2}$	...	...	119	4
Clifton	"	2	7 $\frac{3}{8}$	2	5 $\frac{1}{2}$	2	8 $\frac{1}{2}$	2	...	118	4	6 in. x 6 in. piles.
Stamwell Park	"	2	7	2	11 $\frac{1}{2}$	2	11	1 $\frac{1}{2}$	...	116	4
Otford	"	2	8 $\frac{1}{2}$	2	7 $\frac{1}{2}$	2	9 $\frac{1}{2}$	3	...	113	4	
Lilyvale	"	2	5 $\frac{1}{2}$	2	10 $\frac{1}{2}$	3	0 $\frac{1}{2}$...	3	111	4	20 ft. 10 $\frac{1}{2}$ in.
Hellensburgh	Brick	2	8	2	5 $\frac{3}{8}$	2	9 $\frac{1}{2}$	...	...	107	4
Waterfall	"	2	5 $\frac{1}{2}$	2	2 $\frac{1}{2}$	2	10 $\frac{1}{2}$	3 $\frac{1}{2}$	...	25	5
Heathcote (up line)	"	2	5	2	2 $\frac{1}{2}$	2	8 $\frac{3}{8}$	27	5	6 in. x 6 in. piles, 20 ft. 11 $\frac{1}{2}$ in.
" (down line)	"	2	6 $\frac{1}{2}$	2	3 $\frac{1}{2}$	2	9 $\frac{3}{8}$	...	...	27	5
Loftus Junction (up line)	Timber	2	6 $\frac{1}{2}$	2	10 $\frac{1}{2}$	2	11 $\frac{1}{2}$	1 $\frac{1}{2}$	...	32	5
" (down line)	Brick	2	6 $\frac{1}{2}$	2	11 $\frac{1}{2}$	2	9 $\frac{3}{8}$	1 $\frac{3}{4}$...	32	5	6 in. x 6 in. piles, 20 ft. 18 $\frac{1}{2}$ in.
Loftus	Masonry	2	7 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	9 $\frac{1}{2}$	...	...	33	5
"	Timber (top on rock)	2	7 $\frac{1}{2}$	2	1 $\frac{1}{2}$	2	9 $\frac{3}{8}$	...	...	33	5
"	"	2	8 $\frac{1}{2}$	2	6	2	9 $\frac{3}{8}$	33	5	20 ft. 11 in.
Sutherland (up line)	Brick	2	7 $\frac{1}{2}$	2	3 $\frac{1}{2}$	2	8 $\frac{1}{2}$	...	...	35	5
" (down line)	"	2	7	2	3 $\frac{1}{2}$	2	9 $\frac{1}{2}$	...	...	35	5
Como (up line)	Timber	2	9	3	0 $\frac{1}{2}$	2	9	37	5	6 in. x 6 in. timber, 21 ft. 4 $\frac{1}{2}$ in.
" (down line)	"	2	9 $\frac{1}{2}$	3	0 $\frac{1}{2}$	2	9 $\frac{3}{8}$	...	...	37	5
Oatley (up line)	Brick	2	8	2	4 $\frac{1}{2}$	2	10 $\frac{1}{2}$	...	...	39	5
" (down line)	"	2	7 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	11 $\frac{1}{2}$	39	5	21 ft. 0 $\frac{1}{2}$ in.
Penshurst (up line)	"	2	8	2	4 $\frac{1}{2}$	2	8 $\frac{3}{8}$	1 $\frac{3}{8}$	...	40	5
" (down line)	"	2	7 $\frac{3}{8}$	2	4	2	11 $\frac{1}{2}$	2 $\frac{3}{8}$	...	40	5
Hurstville (up line)	"	2	6 $\frac{3}{8}$	3	4	2	11	1	5	21 ft. 0 $\frac{1}{2}$ in.
" (down line)	"	2	7 $\frac{1}{2}$	2	4	2	11	...	...	2	5
Carlton (up line)	Brick (stone cap.)	2	8 $\frac{3}{8}$	2	5 $\frac{1}{2}$	2	7 $\frac{1}{2}$	...	...	5	5
" (down line)	"	2	8 $\frac{1}{2}$	2	5 $\frac{1}{2}$	2	8 $\frac{3}{8}$	5	5	20 ft. 11 $\frac{1}{2}$ in.
Kogarah (up line)	Brick	2	7 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	10 $\frac{3}{8}$	...	...	6	5
" (down line)	"	2	7 $\frac{1}{2}$	2	5 $\frac{1}{2}$	2	11 $\frac{1}{2}$	...	...	6	5
Rockdale (up line)	"	2	7 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	10	10	5	20 ft. 11 $\frac{1}{2}$ in.
" (down line)	"	2	7 $\frac{1}{2}$	2	5 $\frac{1}{2}$	2	8 $\frac{1}{2}$	...	...	10	5
Arncliffe (up line)	"	2	6 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	10 $\frac{3}{8}$	1	...	13	5	
" (down line)	"	2	6 $\frac{3}{8}$	2	3 $\frac{3}{8}$	2	9 $\frac{1}{2}$	1 $\frac{1}{2}$...	13	5	20 ft. 11 $\frac{1}{2}$ in.
Tempe (up line)	"	2	7	2	4 $\frac{1}{2}$	2	9 $\frac{1}{2}$	2	...	16	5	
" (down line)	"	2	6	2	3 $\frac{3}{8}$	2	9 $\frac{3}{8}$	...	...	16	5
Marrickville (up line)	"	2	7 $\frac{1}{2}$	2	5 $\frac{1}{2}$	2	8 $\frac{1}{2}$	17	5	20 ft. 11 $\frac{1}{2}$ in.
" (down line)	"	2	7 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	8 $\frac{3}{8}$	...	...	17	5
St. Peters (up line)	"	2	5 $\frac{3}{8}$	2	3 $\frac{3}{8}$	2	9 $\frac{1}{2}$	1 $\frac{3}{8}$	...	20	5
" (down line)	"	2	7 $\frac{1}{2}$	2	5	2	8 $\frac{3}{8}$	20	5	20 ft. 10 $\frac{3}{4}$ in.
Erskineville (up line)	"	2	5 $\frac{1}{2}$	2	5	2	8 $\frac{3}{8}$	...	1	24	5
" (down line)	"	2	7 $\frac{1}{2}$	2	5 $\frac{3}{8}$	2	10 $\frac{3}{8}$	...	...	24	5

GREAT WESTERN RAILWAY.

Bourke	...	2	7 $\frac{1}{2}$	2	5	2	9 $\frac{3}{4}$	...	...	1	6	
Mooculta	...	...	...	...	...	...	...	...	...	2	6	
Byrock	...	2	7	2	5	2	10 $\frac{7}{8}$	...	...	3	6	
Glenariff	...	...	...	...	...	...	...	...	...	3	6	
Coolabah	Timber	2	8 $\frac{1}{2}$	2	7 $\frac{1}{2}$	2	8 $\frac{1}{2}$	...	...	3	6	
Wilga	Old sleepers	2	10	2	10	2	8	...	...	4	6	
Girilambone	Bricks	2	6 $\frac{1}{2}$	2	3 $\frac{1}{2}$	2	10	...	...	4	6	
Nyngan	"	2	7	2	5	2	1 $\frac{1}{2}$	...	...	5	6	
Mullengudgery	"	2	4	2	3	2	7	...	...	6	6	
Nevertire	Timber	2	5 $\frac{1}{2}$	2	5 $\frac{1}{2}$	2	4 $\frac{1}{2}$	...	...	6	6	
Trangie	"	2	8	2	11	3	1	...	1	8	6	6 in. x 6 in. piles.
Narromine	Bricks	2	6	2	3	2	7	...	...	8	6	
Minore	Timber	2	7	2	10	2	8	...	...	10	6	8 in. x 8 in. piles.
Dubbo	Masonry	2	7	2	5 $\frac{1}{2}$	2	11	...	...	12	6	
Murrumbidgee	Bricks	2	7	2	5	2	10	...	...	13	6	
Geurie	"	2	5 $\frac{1}{2}$	2	3 $\frac{1}{2}$	2	10	...	...	14	6	
Maryvale	"	2	6	2	3 $\frac{1}{2}$	2	7	1	...	14	6	
Wellington	"	2	6 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	8 $\frac{1}{2}$	...	...	16	6	
Apsley	Timber	2	5	3	5	3	8	...	...	17	6	6 in. x 6 in. piles.
Springs	Bricks	2	7	2	5 $\frac{1}{2}$	2	7 $\frac{1}{2}$	...	...	17	6	
Mumbil	"	2	5 $\frac{3}{4}$	2	3 $\frac{1}{2}$	2	10	...	...	17	6	
Ironbarks	"	2	8	2	5	2	10 $\frac{1}{2}$	2	...	18	6	
Store Creek	Timber	2	8	2	10 $\frac{1}{2}$	2	10	...	...	19	6	6 in. x 6 in. piles.
Warne	Brick	2	6 $\frac{1}{2}$	2	4 $\frac{1}{2}$	2	10	...	...	19	6	
Kerr's Creek	Timber	2	7 $\frac{1}{2}$	3	1	2	9	...	3	20	6	8 $\frac{1}{2}$ in. x 5 $\frac{1}{2}$ in. piles.
Mullion Creek	Brick	2	6 $\frac{1}{2}$	2	3 $\frac{1}{2}$	3	1 $\frac{1}{2}$	...	3	21	6	

Name of Station.	Description of Platform.	Measurements.			Cant.		No. and page in Field Book.	Remarks
		Top.	Bottom.	Height from rail.	In.	Out.		

GREAT WESTERN RAILWAY—continued.

Orange	Brick	ft. 2 6½	in. 2 4	ft. 2 9½	in. 1	in. ...	Page. 28	No. 6
Huntley	Timber	2 7	2 10½	2 10½	...	...	28	6
Spring Hill	Brick	2 7	2 4	2 11	...	...	29	6
Millthorpe	"	2 6½	2 3½	2 11½	...	1	30	6
Blayney	Masonry (brick cap.) ..	2 6	2 4	2 11½	...	...	31	6
Newbridge	Brick	2 5½	2 3	3 0	1½	...	32	6
Wimbeldon	"	2 6½	2 4½	2 9½	3½	...	33	6
George's Plains	"	2 6½	2 3	2 9½	...	...	34	6
Perth	Timber	2 5½	2 5	3 0½	...	...	35	6
"	Brick	2 7	2 4½	2 9½	...	...	35	6
Orton Park	Timber	2 7	2 11½	2 8½	...	...	35	6
Bathurst	Brick (stone cap.)	2 5½	2 4	3 0½	...	...	36	6
"	"	2 6½	2 4½	3 1½	...	...	36	6
Kelso	Brick (concrete cap.) ..	2 5½	2 3½	2 9½	...	...	37	6
Raglan	Brick	2 6½	2 3½	2 8½	1	...	38	6
Brewongle	"	2 6½	2 4½	2 9½	...	...	39	6
Locksley	Timber	2 7½	3 0	2 9½	...	...	42	6
Tarana	Brick	2 6½	2 4½	2 9½	...	...	40	6
Sodwalls	"	2 6	2 3	2 10	...	1	43	6
Rydal	Brick (stone cap.)	2 7½	2 4½	2 8½	...	...	44	6
Wallerawang	Stone	2 6½	2 5	2 11	...	1	44	6
"	Brick (stone cap.)	2 6	2 1	2 11½	...	...	45	6
"	Brick	2 9	2 1½	3 5½	...	...	45	6
Marrangaroo	Timber	2 8½	3 0½	2 7½	1½	...	7	7
Bowenfels	Masonry	2 6½	2 3½	2 10½	1½	...	6	7
Lithgow	Brick	2 6½	2 3½	2 10	...	...	6	7
"	Timber	2 7½	2 10½	2 11	...	...	6	7
Eskbank	Brick (stone cap.)	2 6	2 2	2 9½	...	...	6	7
"	"	2 6	2 1½	2 10½	...	...	6	7
"	"	2 6½	2 1½	2 9½	...	...	5	7
"	"	2 5½	2 1½	2 8½	...	...	5	7
Zig Zag	Timber	2 5½	2 8½	2 10½	1	...	9	7
"	"	2 5½	2 11½	2 9½	1½	...	9	7
Clarence Siding	"	2 5½	2 7½	2 9½	1½	...	9	7
Bell	"	2 5½	2 11	2 10½	...	1	14	7
Hartley Vale	"	2 8½	3 0½	2 8½	...	2	15	7
Mount Victoria	Masonry	2 6½	2 1	2 9½	...	1½	16	7
"	"	2 6½	2 4½	2 11½	1½	...	17	7
Blackheath	Brick (stone cap.)	2 6½	2 4½	2 9½	...	...	18	7
Medlow	Timber	2 7	3 7½	2 8½	...	1	19	7
Katoomba	"	2 6	3 0	2 10½	...	2½	20	7
Wentworth Falls	"	2 5½	2 10	2 9½	...	2½	21	7
Lawson	Brick (stone cap.)	2 5½	2 1½	2 10½	...	1½	22	7
Hazelbrook	Timber	2 6	2 11½	2 9½	...	1	23	7
Woodford	"	2 6½	2 11	2 8½	...	½	23	7
Linden	"	2 6	2 10½	2 10½	...	...	24	7
Numantia	"	2 8	3 0½	2 11½	...	2	24	7
Faulconbridge	"	2 7	2 10½	2 10	...	3	25	7
Springwood	Brick (stone cap.)	2 5½	2 3½	2 10	3½	...	25	7
The Valley	Timber	2 6	2 11½	2 10½	...	½	26	7
Karabar	"	2 6½	2 11	2 9½	...	...	26	7
Blaxland	"	2 5½	2 7½	2 11½	1	...	27	7
Glenbrook	"	2 4½	2 9½	2 10½	...	1½	27	7
Lucasville	Concrete	2 8½	2 5	2 10½	...	1½	28	7
Emu Plains	Brick (stone cap.)	2 6½	2 1	2 8½	...	...	28	7
Penrith	"	2 6	2 2	2 11½	...	...	30	7
Kingswood	Timber	2 5	2 10	2 9½	...	...	33	7
"	"	2 6	2 10½	2 9½	...	...	33	7
Parkes	"	2 5	2 7½	2 10	...	...	33	7
"	"	2 5½	2 10½	2 8	...	...	33	7
St. Mary's	Brick (stone cap.)	2 5½	2 4½	2 9½	...	...	34	7
"	"	2 5½	2 4½	2 10½	...	...	34	7
Mount Druitt	Brick	2 6	2 1½	2 8½	...	...	36	7
"	Brick (stone cap.)	2 6½	2 6	2 9½	...	...	36	7
Rooty Hill	"	2 5½	2 4½	2 11½	1½	...	37	7
"	Timber	2 5½	2 9½	2 9½	1½	...	37	7
Doonside	Brick (stone cap.)	2 6½	2 4½	2 11½	2½	...	38	7
"	"	2 5½	2 4½	2 10½	...	½	38	7
Blacktown	"	2 6½	2 1½	2 11½	...	½	39	7
"	"	2 6½	2 5½	2 10½	...	1½	39	7
Seven Hills	"	2 5½	2 4½	2 11½	1	...	1	8
"	"	2 6	2 4½	2 11½	...	...	1	8
Toongabbie	Timber	2 8½	3 1½	2 6	...	...	2	8
"	"	2 4	2 9½	2 10½	...	2½	2	8
Wentworthville	Brick	2 5½	2 1½	2 9½	1½	...	4	8
"	"	2 7½	2 5	2 11	1½	...	4	8
Westmead	"	2 6	2 1	2 11½	1½	...	3	8
"	"	2 7½	2 5	2 11	1½	...	3	8
Parramatta Park	Timber	2 5½	2 9½	2 8½	2½	...	3	8
"	"	2 7½	2 10½	2 10½	1½	...	3	8
Parramatta	Brick (stone cap.)	2 4½	2 0½	2 11	3½	...	6	8
"	"	2 5½	2 1	2 10½	2½	...	6	8
Harris Park	"	2 6½	2 1	2 10	1½	...	8	8
"	"	2 6	2 0	2 9½	1½	...	8	8

Addition to joint report of trials of new American Engines on 10th April, 1892.

I CONSIDER that the performances, especially of the goods engines, has rarely or never been surpassed by Main Line engines in Australia or Europe.

A load of 350 tons, exclusive of engine and tender, is the maximum load hauled up gradients of 1 in 100 in regular service in Great Britain, and on many lines the regular load for this gradient (which on our lines is moderate), is less than the American consolidation engine hauled unassisted up a gradient of 1 in 40, with long ten chain curves.

The train the passenger engine hauled up the 1 in 33 gradient is equal to 7 lavatory carriages in weight. The power of the engine needs no further demonstration, as such a train exceeds the carrying capacity of the majority of fast express trains both in England and America, where such trains are more-over generally assisted over gradients steeper than 1 in 70.

D. H. NEALE, 11/4/92.

Secretary.

The Secretary to The Railway Commissioners.

Addendum to Report on Trials of American Engines on 10th April, 1892, between Wallcrawang and Mount Victoria.

23 April, 1892.

HAVING suspected from the behaviour of the engines on the 1-40 grade at Marangaroo that it was somewhat steeper than 1-40, I find now, from a special survey just made under the direction of the Engineer-in-Chief for Existing Lines, that after passing over 50 chains of 10-chain reversed curves without any intermediate straight the engine came to a piece of 1-37.5 five chains in length, and that this doubtless checked the engine and was the cause of the slow average speed up the bank, as the check caused by the extra grade was coincident with the effect of the curvature and the engine slipping. The fact that the engine was able to pull the train up the bank, despite this combination of grade and curvature, speaks volumes for the power of the engines. I annex tracing of the grade.

D. H. NEALE.

A

APPENDIX A.
(See page 204)

N.S.W.R.

WESTERN LINE

DIAGRAM OF GRADES

PENRITH TO BATHURST

SCALES

Horizontal—3 Miles to inch
Vertical—400 Feet do do

NOTE



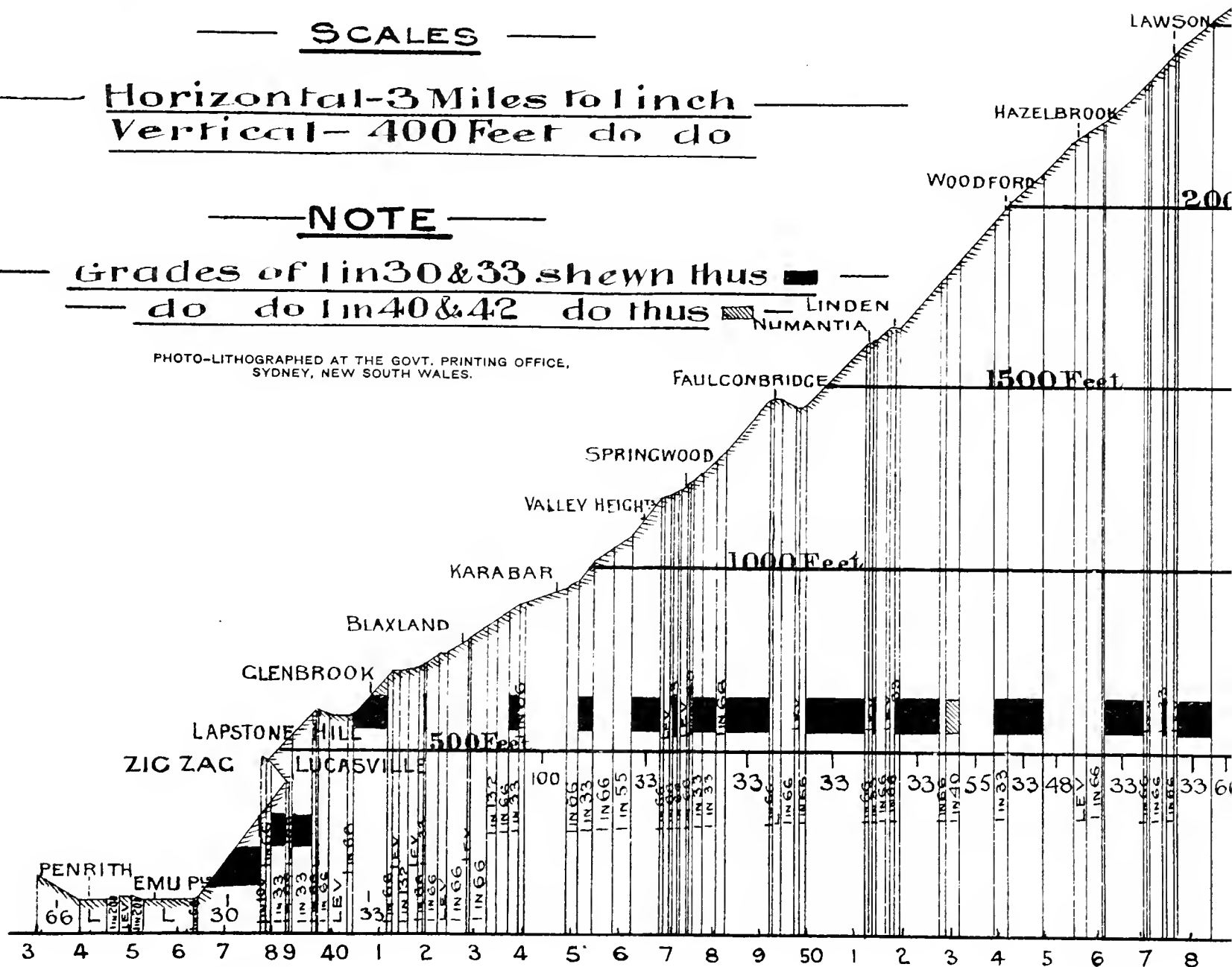
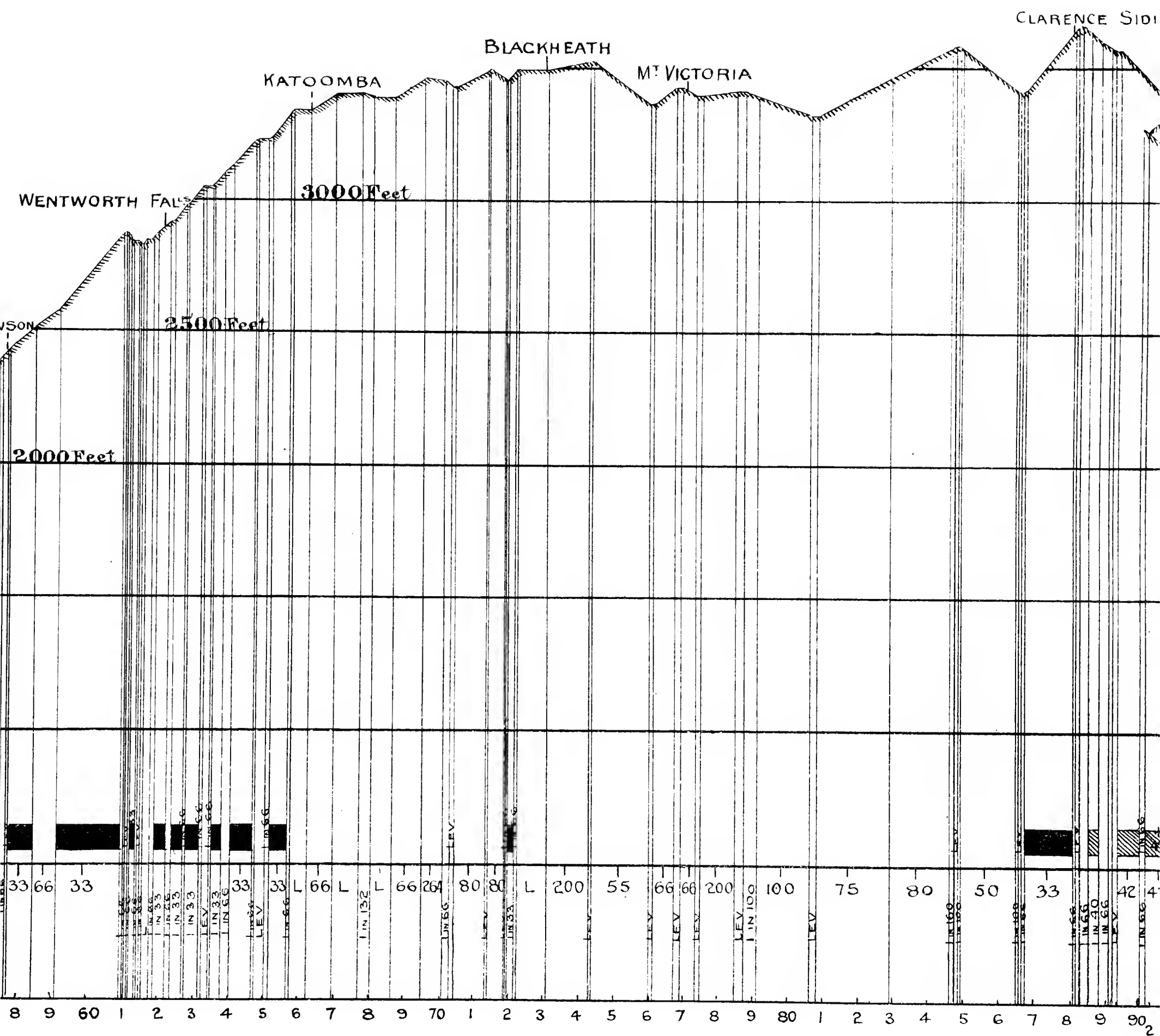
Grades of lin30&33 shewn thus 
do do lin40&42 do thus  LINDEN
NUMANTIA

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(Sig6)



SIDING Summit Level 3658 Feet

3500 Feet

ZIG ZAG

ESKBANK

BOWENFELS

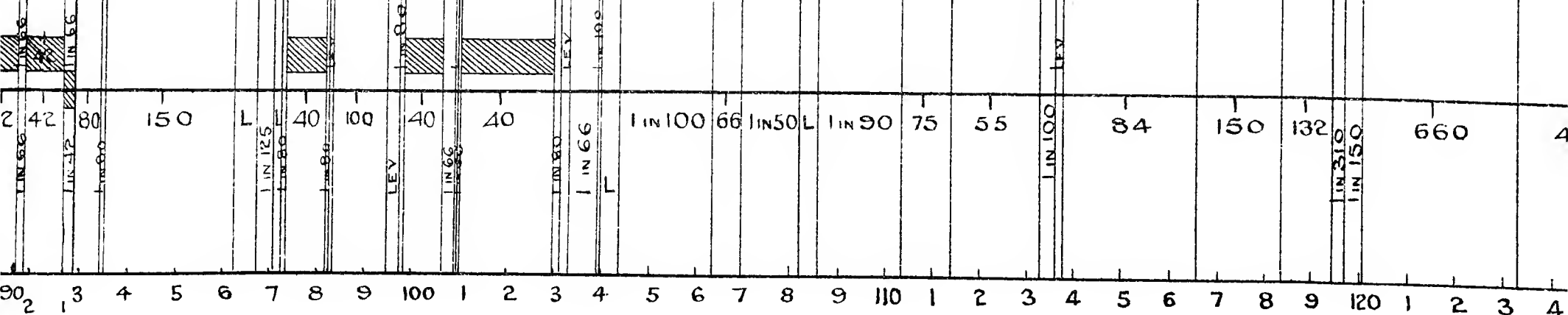
WALLERAWANG

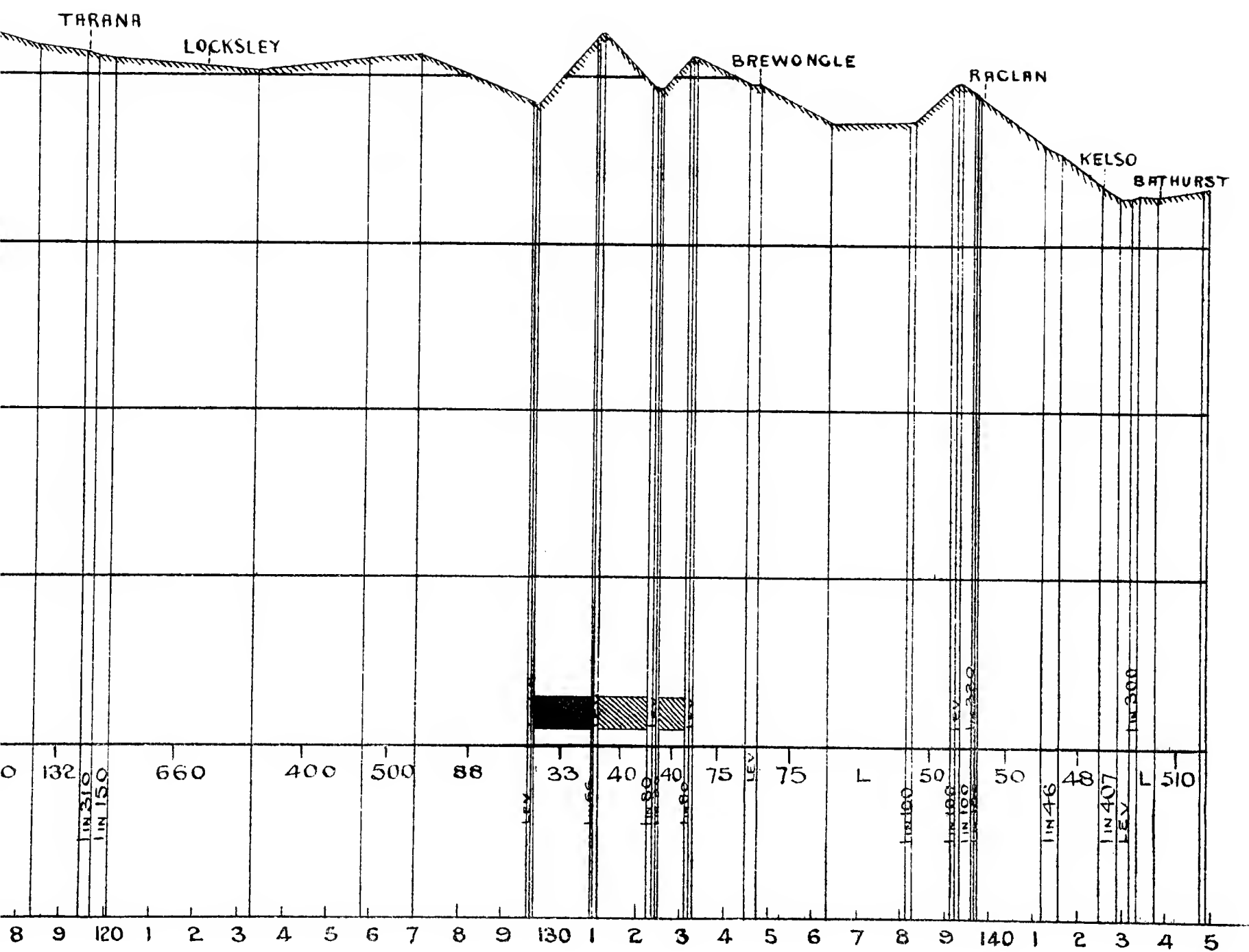
RYDAL

SODWALLS

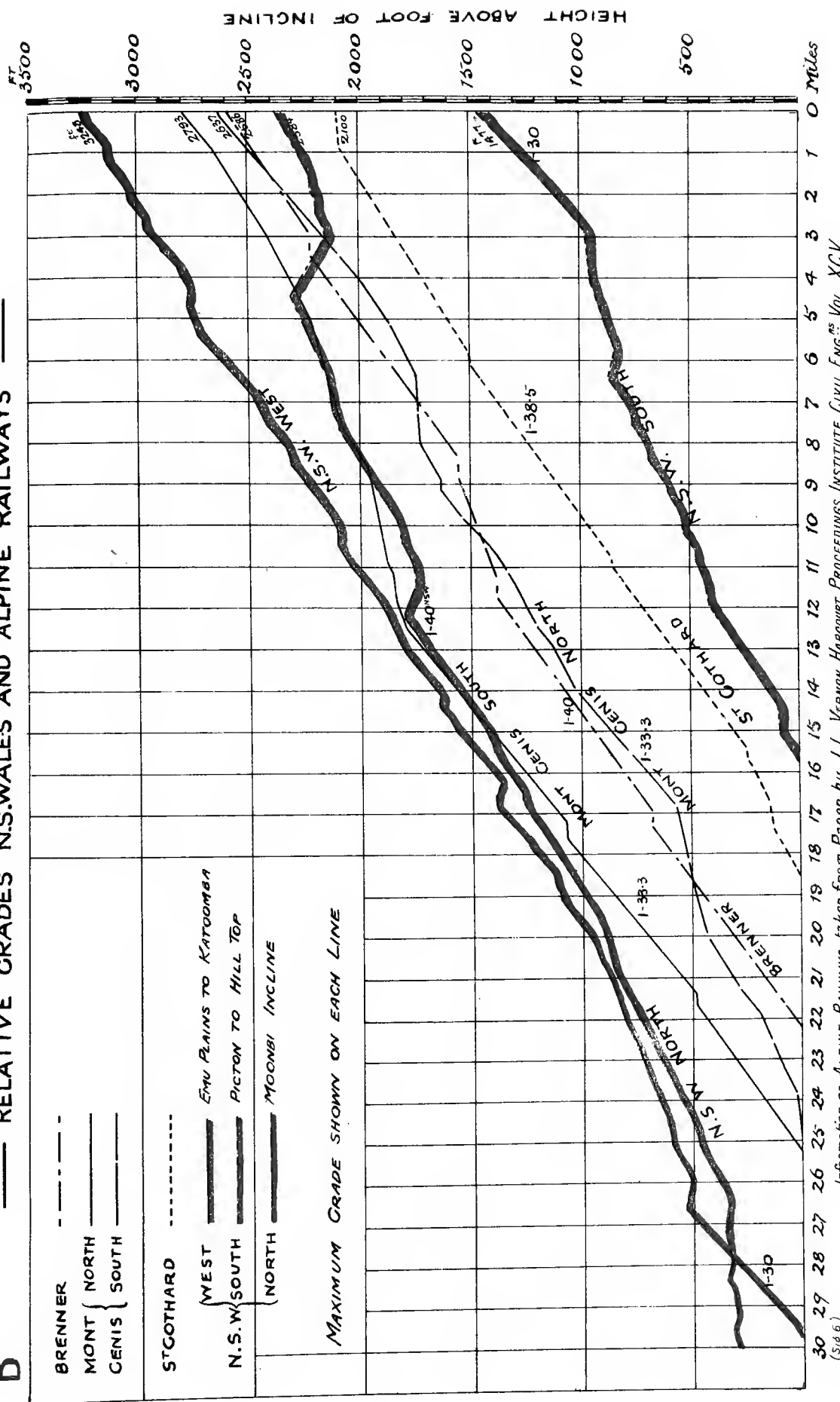
TARANA

LOCKSLEY





— RELATIVE GRADES N.S.WALES AND ALPINE RAILWAYS



30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Miles

(51g 6)

Information re ALPINE RAILWAYS taken from Paper by J. L. VERNON HARCOURT, PROCEEDINGS INSTITUTE CIVIL ENGINEERS VOL. XCV.

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(See p. 204.)

NEW SOUTH WALES GOVERNMENT RAILWAYS.

COMPARATIVE GRADES, CURVES, &c., on N.S.W. and ALPINE RAILWAYS.

Railway.	Portion of Line shown on Diagram.				Portion of Line <i>not</i> shown on Diagram.	
	Length of Incline. (Miles.)	Rise. (Feet.)	Maximum Grade Ascending.	Sharpest Curve. (Chains.)	Remarks.	Maximum Grade Ascending.
Brenner ...	22.25	2,586	1-40	14.16	Rises <i>Nil.</i> ...	...
Mont Ceniz, North ...	24.75	2,637	1-33.3	17.0	Do. <i>do.</i> ...	...
Mont Ceniz, South ...	25.25	2,793	1-33.3	24.0	Do. 13 feet in $3\frac{1}{2}$ miles ...	1-1,000
St. Gothard ...	18.5	2,100	1-38.5	14 to 15	Do. 126 feet in $4\frac{1}{4}$ „ ...	1-172
N. S. W. (West) ...	29.5	3,248	1-30	8	Do. 323 feet in 22 „ ...	1-33
N. S. W. (South) ...	15.5	1,477	1-30	16	Do. 322 feet in 23 „ ...	1-30
N. S. W. (North) ...	30.0	2,105	1-40	12	{ Do. 890 feet in 71 „ ... { Falls to Zero from foot of incline in 17 miles ...	1-44 1-50

Particulars as to “Alpine Railways” taken from a Paper by Mr. L. F. Vernon Harcourt, Vol. 95, Minutes Institution of Civil Engineers.

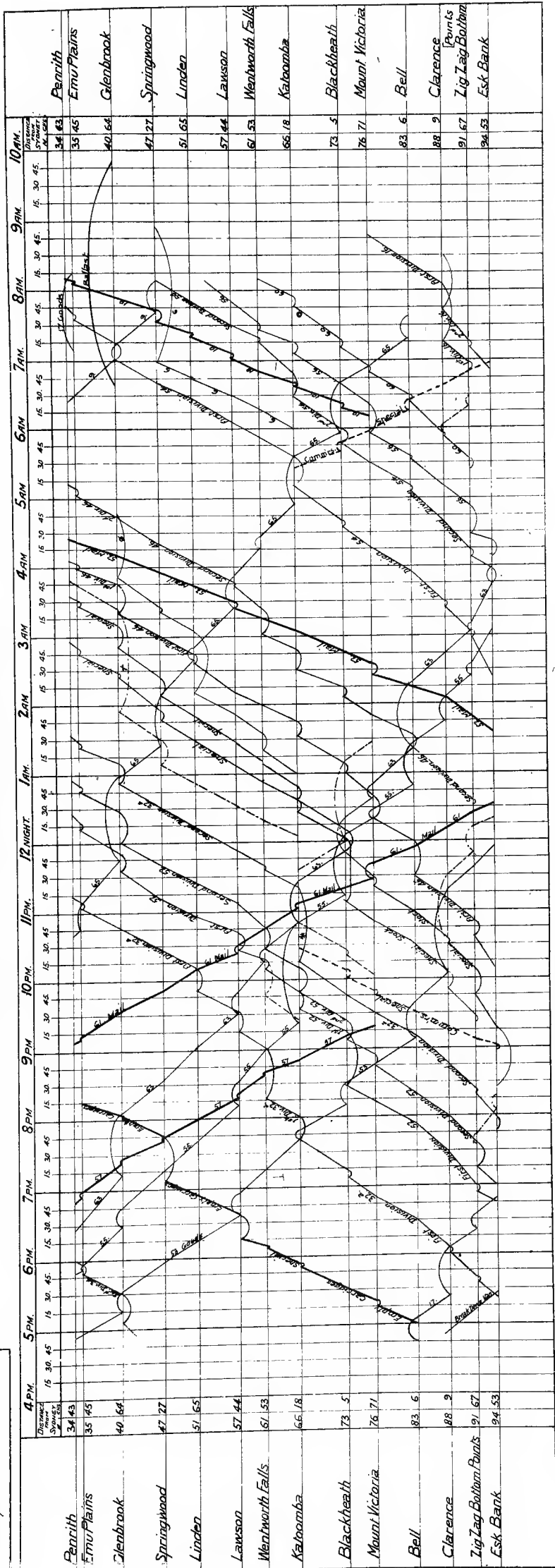
APPENDIX C.
(See p. 204.)

N.S.W.C.R.'s

DIAGRAM SHEWING RUNNING OF TRAINS BETWEEN PENRITH AND ESKBANK AND VICE VERSA

BETWEEN 5 PM. ON 27TH AND 8 AM. ON 28TH APRIL 1892.

Passenger Trains thus ———
Goods Trains and
Lock Trains thus ———
Light Engines thus ———
Miners' Specials thus - - - - -



(Sig 6)

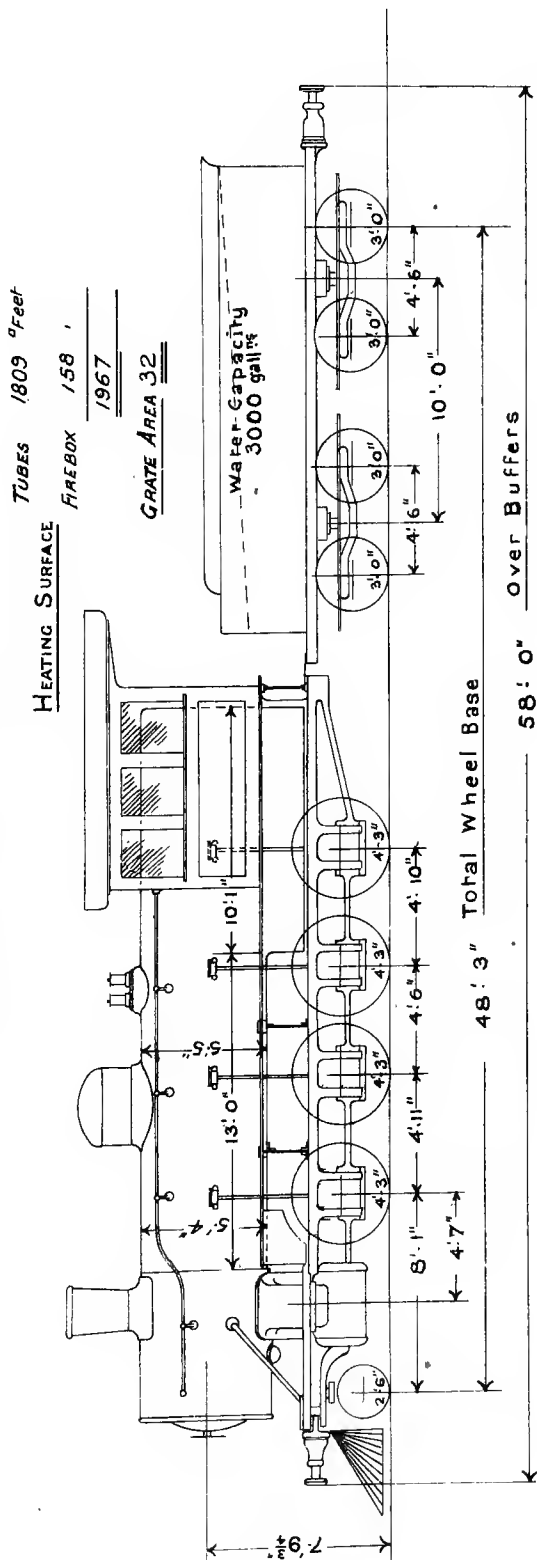
- * Crossing Nos 55, 63 & 61 Down Trains.
- † Waiting to take forward Live Stock put off by Trains reducing their load at Glenbrook
- ‡ Shunting off Coal and picking up Live Stock

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(See p. 205)

CONSOLIDATION GOODS. -- BUILT BY THE BALDWIN COY.

Engines Class J.(483)



Cylinders 21" x 26" Stroke

NOTE:- THE TWO MIDDLE PAIRS OF COUPLED WHEELS ARE FLANGELESS

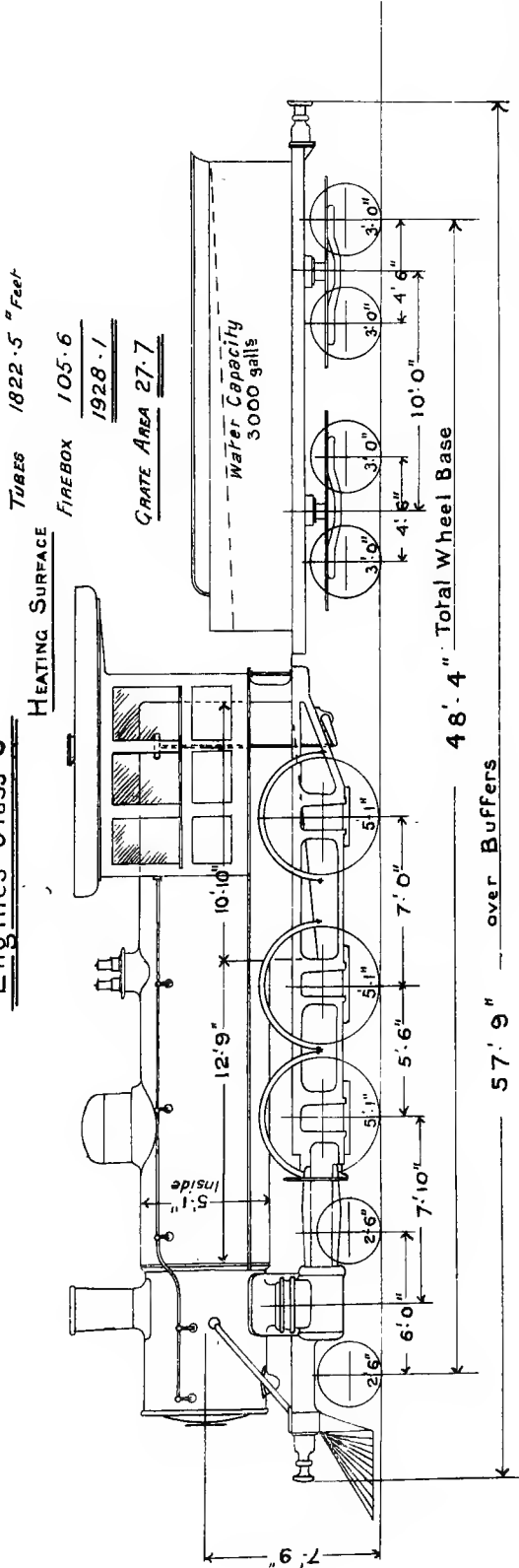
	EMPTY		RUNNING ORDER	
	T	C	T	C
Weight Engine	55	15	62	12
Tender	13	12	32	0
Total	69	27	94	12

Total weight on 4 sets of driving wheels when loaded. 56.15-3

(9.815)

10 WHEELED EXPRESS.— BUILT BY THE BALDWIN COY.

Engines Class O



	EMPTY			RUNNING ORDER		
	T	C	Q	T	C	Q
Weight Engine	51	5	0	58	7	2
" Tender	13	12	0	32	0	0
" Total	64	17	0	90	7	2

Cylinders 21" x 24" Stroke

NOTE: THE CENTRE PAIR OF COUPLED WHEELS
ARE FLANGELESS

Total weight on 3 sets of driving wheels when loaded 43.11.0

E

APPENDIX E.
(See p. 207.)

10 WHEELED (ENGLISH) EXPRESS, BUILT BY MESSRS BEYER, PEACOCK & CO

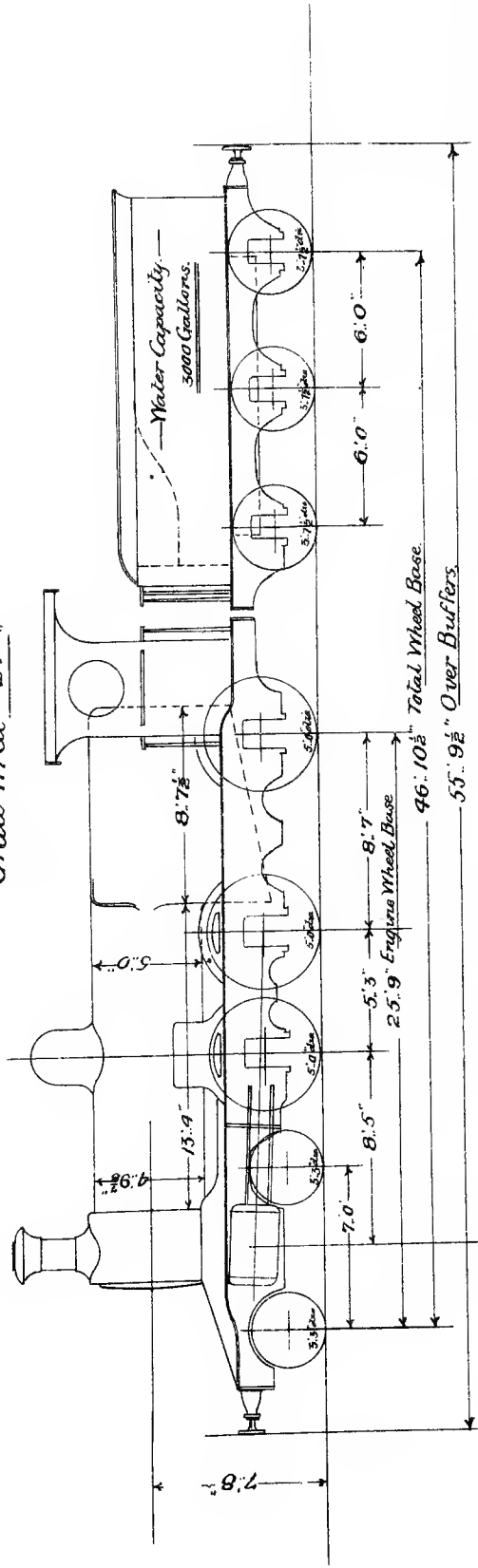
Engines Class "P"

Heating Surface { Tubes 1786 sq ft

Fire-box 130 "

Total 1916 "

Grate Area 27 "



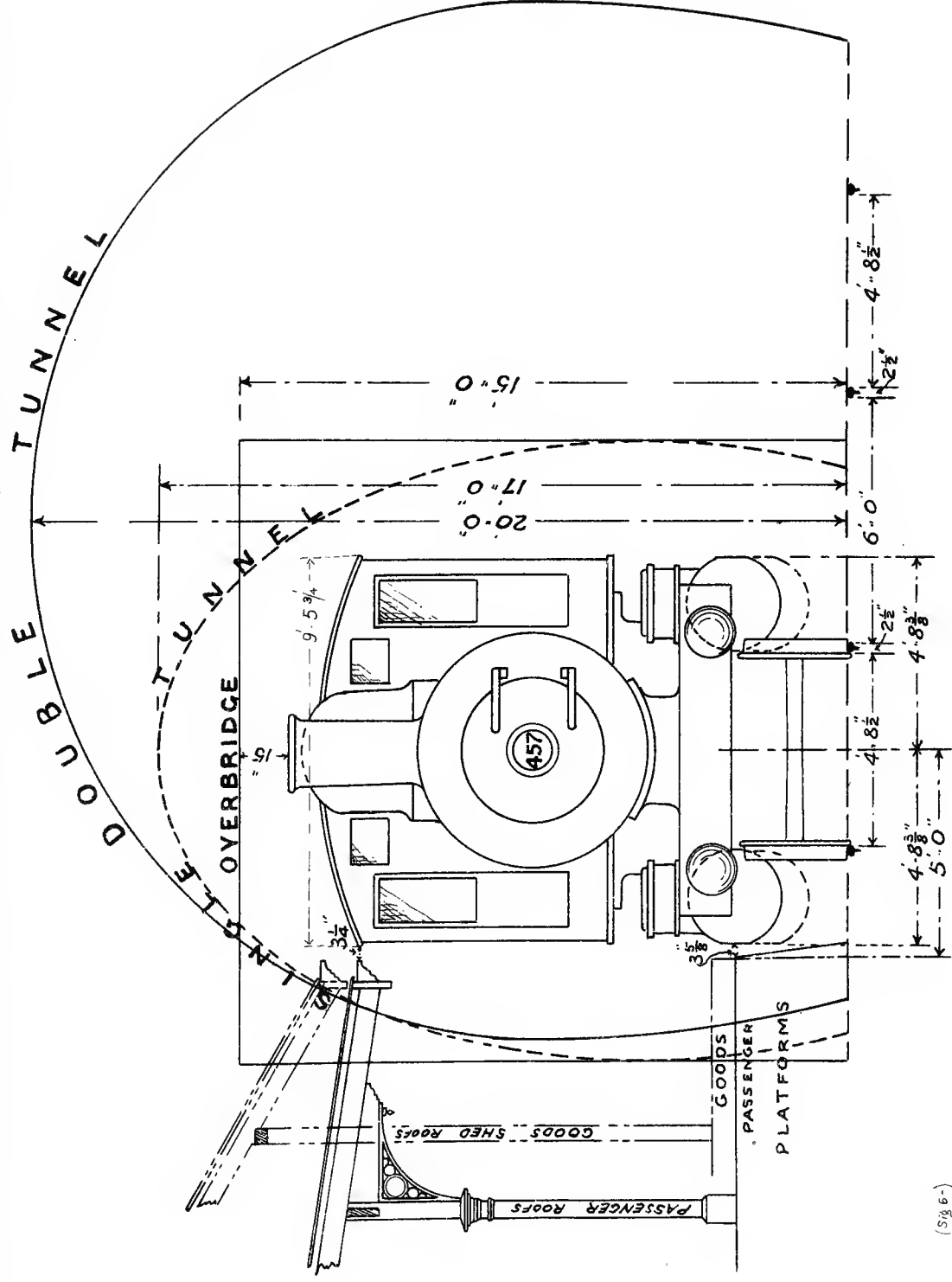
Weight Empty. --- 15-14-2 --- 12-5-3 --- 12-5-1 --- 12-1-2 --- 5-2-3 --- 5-1-0 --- Total Weight Empty. --- 65-13-3,
in Steam. --- 7-4-0 --- 7-9-2 --- 14-10-3 --- 14-13-0 --- 12-13-2 --- 10-13-0 --- 10-10-1 --- do. --- in Steam. --- 89-7-0
Coal Capacity --- 4½ Tons.

(Sig 6.)

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M. Moss

Diagram shewing Profile of Baldwin Engines, in Connection with the existing Structures throughout the Railway System.



(5126-)

APPENDIX F₂.
(See p. 207)

F₂

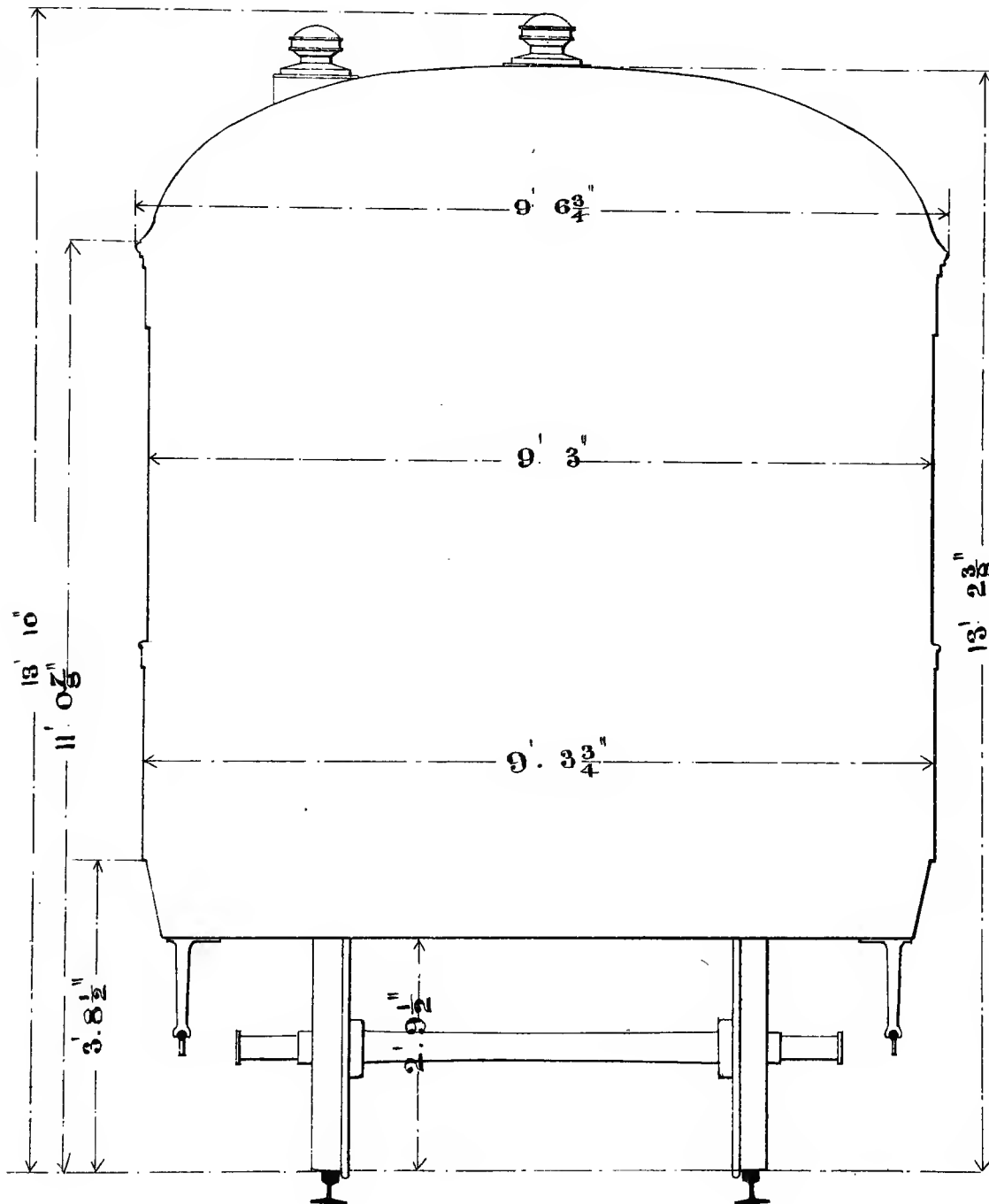
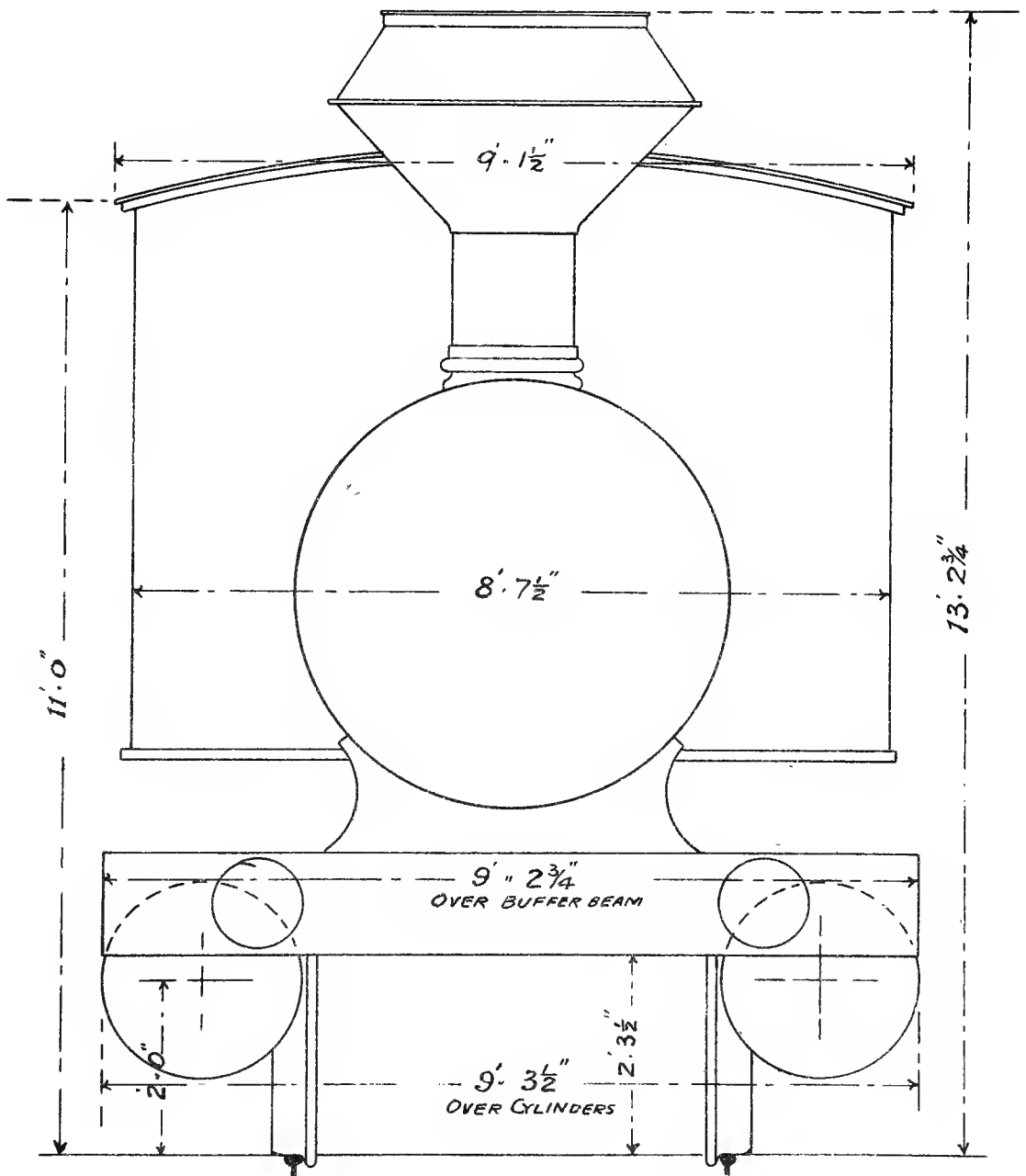


DIAGRAM
SHOWING "MANN CAR"
Ordered prior to the Commissioners taking Office

APPENDIX G.
(See p 207)

*Diagram of Engine N^o 132 Class J.
(Running upon some portions of the lines since 1879.)*

G



APPENDIX H.
(See p. 210.)

WEIGHTS OF RAILS AND EXPRESS PASSENGER ENGINES.
WEIGHTS OF RAILS, AMERICAN ROADS, TAKEN FROM POOR'S MANUAL, 1891.

Railway.	Total Weight in working order.		Maximum weight on one axle.	Weights of Rails per yard.		Weight of Steel Rail per yard, per ton on each wheel.		Remarks.	Authority for Weights of Engines.
	Engine.	Engine and Tender.		Iron.	Steel.	Lightest Rail.	Heaviest Rail.		
Central of New Jersey	tons. 55 6	tons. cwt.	tons. 19 14†	lb. 56 and 65	lb. 62, 62½, and 70	lb. 6·3	lb. 7·1	Runs regularly 70 to 90 miles per hour.	R. R. Gazette, Feb. 12, 1892.
Baltimore and Ohio	59 8	93 6	15 14	60-80	67	8·5	9·0	Runs regularly Empire State Express, fastest train in the world.	" Nov. 27, 1891.
New York Central	57 1	89 6	17 16†	none	65 and 80	7·4			" Sept. 18 "
Philadelphia and Reading	50 0	.....	17 0†	none	{ 56, 58, 60, 64, 68, } 70, 88, and 90. }	6·6	10·6	Has run 91·7 miles per hour...	" Nov. 13 & 27, 1891
C.C.C. and St. Louis...	58 13	92 19	15 6†	mostly steel	67	8·8			" Jan. 1, 1892.
Erie	58 0	92 0	15 0†½	.....	56-65	7·4	8·7		" June 13, 1890.
Atchison, Topeka, and St. Fé	58 0	.....	15 9†	(3095 miles)	{ 56-65 } (4015 miles)	7·2	8·4		" Aug. 15 "
Chesapeake and Ohio	59 5	.....	15 6	.....	56, 62, and 75	7·3	9·8		R. R. Journal, July "
Master Mechanics	59 8	.....	14 18†	.....	.....	.....	.....		R. R. Gazette, Jan. 8, 1892.
L. & N. W. R.	52 0	77 2	15 10	.....	84-90	10·8*	11·6*		Engineering, Nov. 13, 1891.
North Eastern	46 13	86 13	17 15	.....	? 90	.....	10·1*	Has attained highest speed (86 miles per hour) ever attained in England.	R. R. Journal, May, 1890.
Great Northern	45 3	78 11	17 0	.....	82	.....	9·6*	Runs fastest trains in England last 20 years.	Engineering, May 20 "
N.S.W. (10-wheeled Baldwin)	58 7	90 6	15 5½	70 and 75	71, 75, and 80	9·2	10·4		
Eastern of France	54 18	97 1	16 2	... ..	69-89½§	8·5	11·0	Running fast expresses	Engineer, March 4, 1892.

* As this Engine has the wheels and springs without equalizers, it is liable to have a considerably greater weight on the wheels.
† Average weight on each pair of coupled wheels.
§ The heavier rail has only been used of late years on parts of the line. The Engineer-in-Chief of the Permanent Way reports that 10% additional weight could be carried on the 69-lb. rail.

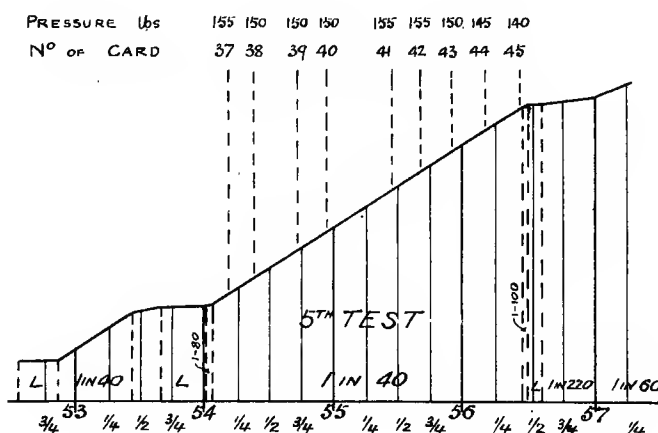
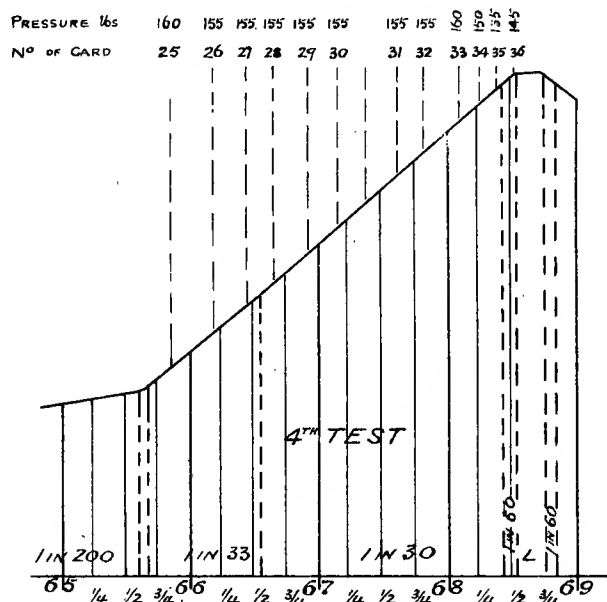
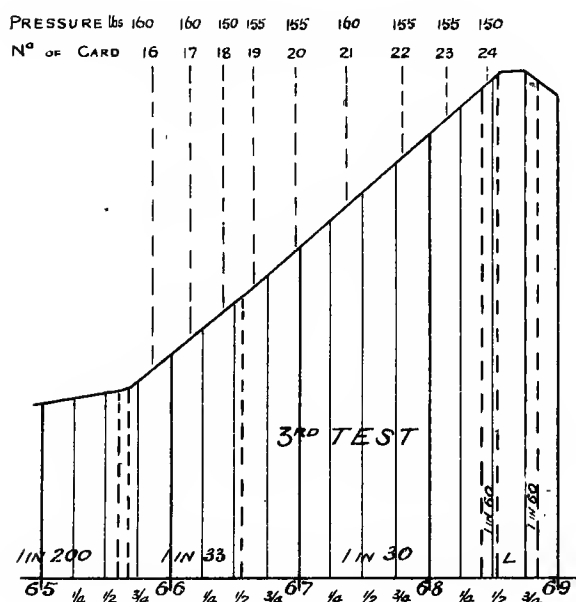
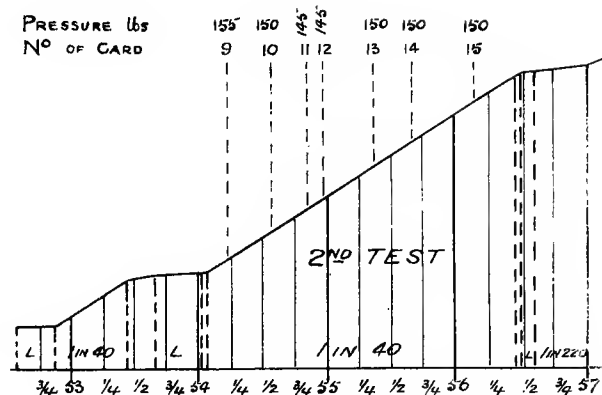
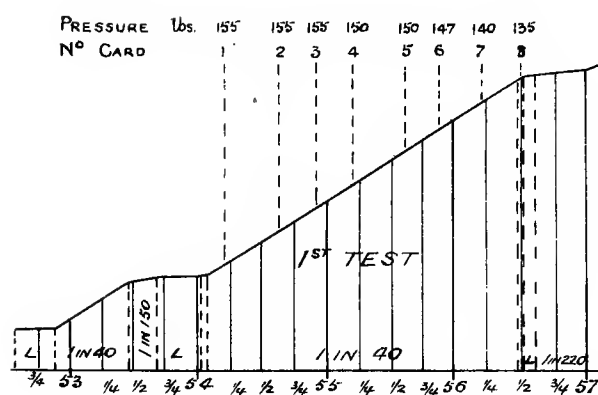
APPENDIX I.

— Appendix to report by Messrs Kidd & Pollock —

— DIAGRAM OF GRADE —

SHOWING WHERE INDICATOR CARDS WERE TAKEN

AND CORRESPONDING BOILER PRESSURE



(Sig. 6)

PHOTO-LITHOGRAPHED AT THE GOVT. PRINTING OFFICE,
SYDNEY, NEW SOUTH WALES.

APPENDIX TO MESS^{RS} KIDD AND POLLOCK'S REPORT.

CC



NEW SOUTH WALES RAILWAYS (SOUTHERN MAIN LINE)

Diagram of Grades PICTON TO MITTAGONG

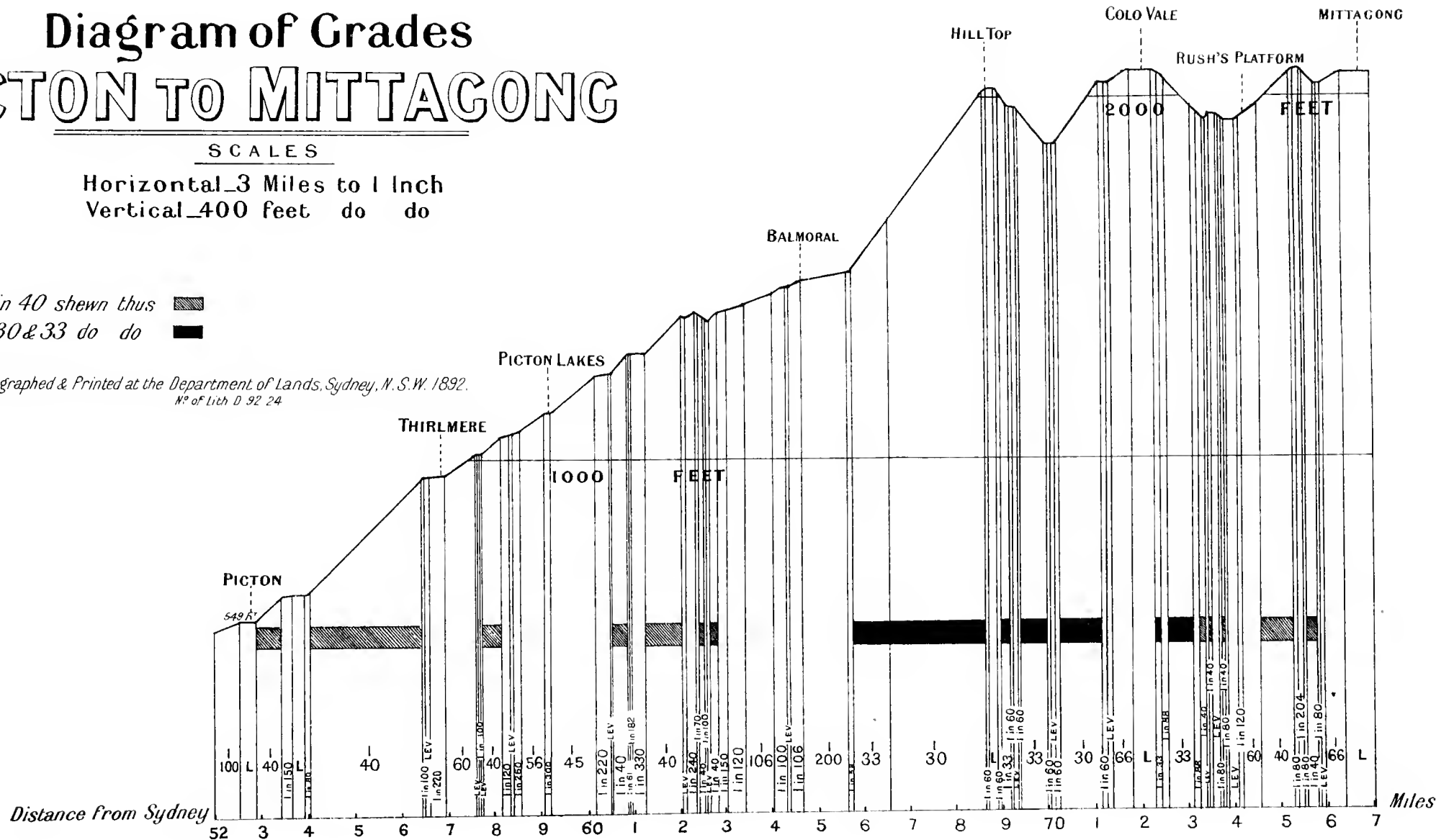
SCALES

Horizontal 3 Miles to 1 Inch
Vertical 400 feet do do

NOTE

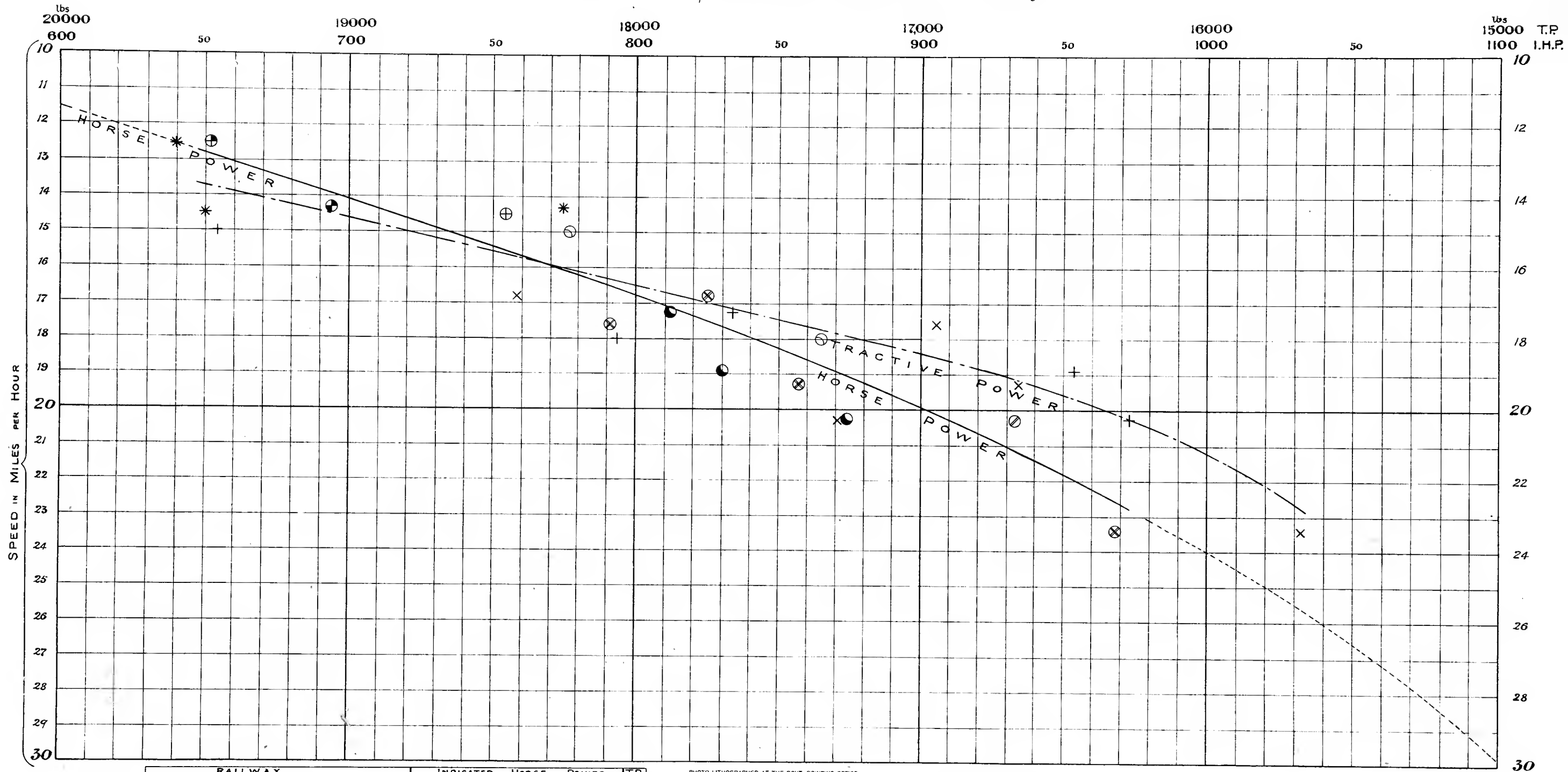
Grades 1 in 40 shewn thus 
do 1 in 30 & 33 do do 

Lithographed & Printed at the Department of Lands, Sydney, N.S.W. 1892.
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— LOCOMOTIVES —

— TRACTIVE POWER & HORSE POWER INDICATED AT VARIOUS SPEEDS —
 — 10 Wheeled Baldwin, N.S.Wales & Baltimore & Ohio Railways —



NOTE

RAILWAY	INDICATED HORSE POWER	T.P.
BALTIMORE & OHIO TRIALS	⊗ UP 1-46.3, ⊙ UP 1-56	X
N.S.W. WALLERAWANG TRIALS	⊕ 1-33, ⊕ 1-40, ⊙ 1-50	*
" " " PICTON	⊙ 1-30, ⊙ 1-40	+

(Sp 6).

PHOTO-LITHOGRAPHED AT THE GOVT. PRINTING OFFICE,
 SYDNEY, NEW SOUTH WALES.

H. H. Hale

(67) Sydney N.S.W.
 28.6.92

